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VOL. CXXXIV.—No. 3484] LONDON: FRIDAY EVENING, OCTOBER 6, 1922 [PRICE ONE SHILLING BY INLAND POST 1s. 3d.

PUBLIC NOTICES

The High Commissioner for India is prepared to receive TENDERS for the SUPPLY of :—
DRILLS, TWIST, HIGH-SPEED.
Forms of Tender may be obtained from the Director-General India Store Department, Branch No. 15, Belvedere-road, Lambeth, S.E. 1, and Tenders are to be delivered at that office not later than Two o'clock p.m. on Friday, the 27th October, 1922.
T. RYAN,
428 Director-General.

Appointments Board of the IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY, SOUTH KENSINGTON, S.W. 7.
EMPLOYERS REQUIRING MEN who have received a thorough training in Science and Technology and who are Diplomates or Associates of the Imperial College or of one of its three constituent Colleges, are asked to make use of the services of the Board. No fees.
The Imperial College includes the Royal College of Science, the Royal School of Mines, and the City and Guilds (Engineering) College. The Associates of the Colleges receive thorough training in Science and Technology, including Aeronautics, Applied Optics and Optical Engineering, Biology, Chemical Technology, Chemistry (all branches), Engineering (all branches, including Metallurgy, Mining, Mining Geology and Oil Technology), Geology, Mathematics and Mechanics, and Physics. 439

Leyton Higher Education Committee.
LEYTON TECHNICAL INSTITUTE.
An INSTRUCTOR for the ENGINEERING WORKSHOP is REQUIRED; salary from £225-£250, according to qualifications and experience. Candidates should have had a sound practical training, together with recent workshop practice, and possess a recognised diploma or degree in engineering.
Apply at once, sending stamped addressed foolscap envelope for form of application to the undersigned.
R. J. GELDART,
Clerk to the Committee.
Town Hall, Leyton, E. 10. 458

Auckland Harbour Board, New ZEALAND.
TENDERS are INVITED for the SUPPLY and DELIVERY of :—
TWELVE (12) 5-Ton (and alternatively for 3-Ton) Semi-portal Balanced Jib ELECTRIC QUAY CRANES.
FOUR (4) 5-Ton (and alternatively for 3-Ton) Balanced Jib ELECTRIC ROOF CRANES.
SIX (6) 1-Ton ELECTRIC MONO-RAIL CRANES.
Specifications, diagrams and forms of Tender can be obtained at the office of the Board's Agents, Messrs. W. and A. McArthur, Ltd., 18/19, Silk-street, Cripplegate, London, E.C. 2, on payment of a deposit (returnable) of Two Guineas.
Tenders to reach Auckland by Noon on February 1st, 1923, addressed "The CHAIRMAN, Harbour Board, Auckland, New Zealand." 9008

Bengal-Nagpur Railway Company, LIMITED.
The Directors are prepared to receive TENDERS for the following :—
WHEELS AND AXLES.
Specification and form of Tender can be obtained at the Company's Offices, 132, Gresham House, Old Broad-street, London, E.C. 2, on or after 2nd October, 1922.
A fee of £1 1s. will be charged for the specification, which will not be returned.
Tenders must be submitted not later than Noon on Monday, 16th October, 1922.
The Directors do not bind themselves to accept the lowest or any Tender.
By Order of the Board,
T. E. WYKNE,
441 Managing Director.

Bethnal Green Board of Guardians.
LAUNDRY CALENDER.
The Bethnal Green Board of Guardians invite TENDERS for the SUPPLY and INSTALLATION of ONE FOUR-ROLL LAUNDRY CALENDER at their Institution, Waterloo House, Waterloo-road, Bethnal Green, E. 2.
Specification and Tender form may be obtained by forwarding a stamped directed envelope to the undermentioned address.
Tenders must be received at my office not later than Twelve Noon on Tuesday, the 17th October, 1922.
The Guardians do not bind themselves to accept the lowest or any Tender.
C. FAULKNER JONES,
Clerk to the Guardians.
Administrative Offices,
79A, Bishop's-road,
Bethnal Green, E. 2.
28th September, 1922. 430

Borough of Port Talbot.
TO MAKERS OF STEAM ROLLERS.
The Corporation invite TENDERS for a 10-TON COMPOUND-CYLINDER STEAM ROLLER; also TWO-TINE SCARIFIER, WATER SPRAYER to Hind and Front Rollers, A WINCH over Tender, and WATER ELEVATOR and HOSE.
Tenders, sealed and endorsed "Tender, Steam Roller," to be forwarded to the undersigned on or before the 11th October next.
MOSES THOM,
Town Clerk.
September 28th, 1922. 434

Corporation of Durban, Natal.
TENDERS FOR STONEWARE PIPES.
The Corporation of Durban, Natal, is prepared to receive (from British manufacturers only) TENDERS for the SUPPLY and DELIVERY at Durban of 1 MILE of 14in., 1¼ MILES in all of 12in., 9in., 8in., 7in., 6in., and 4in. of best quality STONEWARE PIPES, together with a QUANTITY of SPECIALS.
Specifications can be obtained from the undersigned on deposit of Two Guineas, which will be returned on receipt of bona fide Tender.
Sealed and endorsed Tenders to be delivered to the undersigned on or before Wednesday, 18th October, 1922.
The lowest or any Tender will not necessarily be accepted.
By Order,
WEBSTER, STEEL and CO.,
Agents to the Corporation,
5, East India-avenue,
Leadenhall-street,
London, E.C. 3. 449

The Engineer

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PUBLIC NOTICES

Carshalton Urban District COUNCIL.
TENDERS are INVITED for about 1000 LIN. YDS. WROUGHT IRON RAILINGS, GATES, HURDLES, &c., erected complete at Carshalton, Surrey. A schedule of the work and form of Tender can be obtained from the Surveyor, Mr. W. W. Gale, A.M.I.C.E., at this office. Tenders to be endorsed "Iron Railings" and to be delivered to the undersigned by Twelve Noon on the 17th October, 1922.
The Council do not bind themselves to accept the lowest or any Tender.
By Order,
C. P. LOVELOCK,
Clerk.
District Council Offices,
The Square, Carshalton,
2nd October, 1922. 457

County Borough of Southampton.
TENDER FOR LAYING WATER PIPES.
The Corporation invite TENDERS for the LAYING and JOINTING of about 3350 LINEAL YARDS of C.I. WATER MAIN, 12in. diameter, from Swaythling Station to New Inn, West End, together with contingent Works.
Forms of Tender, specification and bills of quantities and schedule may be obtained from, and drawings inspected at, the Waterworks Engineer's Office on and after the 4th proximo, upon the production of the Borough Treasurer's receipt for a deposit of £1 1s., which will be returned, after the Council have dealt with the Tenders, to contractors who have submitted bona fide Tenders, together with the return of all documents supplied.
Sealed Tenders, endorsed "Tender for Swaythling to West End Main," must be delivered at the Town Clerk's office not later than 10 a.m. on the 12th proximo.
No pledge is given to accept the lowest or any Tender.
R. R. LINTHORNE,
Town Clerk.
25th September, 1922. 437

County Borough of Southampton.
TENDER FOR C.I. PIPES AND SPECIAL CASTINGS.
The Corporation invite TENDERS for the SUPPLY of about 360 TONS of 12in. diameter C.I.S. and S. PIPES, and about 4 TONS of SPECIAL CASTINGS.
Form of Tender, specification, bill of quantities and schedule may be obtained at the Waterworks Engineer's office on and after the 4th proximo upon production of the Borough Treasurer's receipt for a deposit of £1 1s., which will be returned, after the Council have dealt with the Tenders, to contractors who have submitted bona fide Tenders, together with the return of all documents supplied.
Sealed Tenders, endorsed "Tender for C.I. Pipes and Special Castings," must be delivered at the Town Clerk's Office not later than 10 a.m. on the 12th proximo.
No pledge is given to accept the lowest or any Tender.
R. R. LINTHORNE,
Town Clerk.
25th September, 1922. 438

East Indian Railway.
The Directors are prepared to receive up to Eleven o'clock a.m. TENDERS for the SUPPLY of :—
(1) BRASS BOILER TUBES and COPPER PIPES.
(2) COPPER FIRE-BOX PLATES.
(3) LOCOMOTIVE BOILERS, &c.,
for Nos. 1 and 2 on Wednesday, the 18th October instant, and for No. 3 on Wednesday, the 25th October instant.
Copies of the specifications can be obtained at the Company's offices on payment of £1 1s. This fee will not be returned.
G. E. LILLIE,
Secretary.
73-76, King William-street,
London, E.C. 4,
4th October, 1922. 465

PUBLIC NOTICES

Great Northern Railway (Ireland).
TENDERS FOR SWITCHES.
The Directors are prepared to receive TENDERS for SWITCHES, in accordance with the Company's drawing and specification, copies of which may be obtained from the undersigned.
Tenders, made out on the forms supplied by the Company, should be delivered, under sealed cover, endorsed "Tender for Switches," not later than 10 a.m. on Monday, October 23rd.
The Directors do not bind themselves to accept the lowest or any Tender.
J. B. STEPHENS,
Secretary.
Amiens-street Station, Dublin,
3rd October, 1922. 470

Hull Corporation.
CHANTERLANDS AVENUE EXTENSION.—RAILWAY BRIDGE.
TO PUBLIC WORKS CONTRACTORS AND STRUCTURAL ENGINEERS.
The Corporation are prepared to receive TENDERS for a RAILWAY BRIDGE in connection with Chanterlands Avenue Extension. The work consists of Abutments, Wing Walls, Piling, &c., and Steel Girders, Stanchions, Flooring, &c.; total weight of steelwork 150 tons.
Contractors shall Tender for the whole of the work, but a public works contractor may sublet the steelwork and, similarly, a contractor of structural steelwork may sublet the abutments, wing walls, piling, &c.
Forms of Tender and other particulars can be obtained at the City Engineer's Office on payment of £1, which will be returned to firms submitting a bona fide Tender. Prints of the four contract plans can be obtained on payment of Ten Shillings, not returnable. Remittances must be made payable to Mr. T. G. Milner, City Treasurer.
Tenders, endorsed "Tender for Bridge, Chanterlands Avenue," are to be addressed to the Chairman of the City Improvement Committee, and delivered at the Town Clerk's Office, Hull, before Noon on Monday, the 30th October.
The Corporation do not bind themselves to accept the lowest or any Tender.
By Order,
F. W. BRICKNELL, M. Inst. C.E.,
City Engineer.
Guildhall, Hull,
30th September, 1922. 356

Madras and Southern Mahratta RAILWAY COMPANY, LIMITED.
The Directors are prepared to receive TENDERS for :—
1200 STEEL TYRES for CARRIAGE and WAGON WHEELS,
in accordance with the specification, which may be seen at the offices of the Company. The charge for each specification is One Guinea, which will not be returned.
Tenders must be sent in, addressed to the SECRETARY, not later than 2 p.m. on Tuesday, 17th October, 1922, marked "Tender for Steel Tyres."
The Directors do not bind themselves to accept the lowest or any Tender.
THESE TYRES ARE URGENTLY REQUIRED IN INDIA.
Company's Offices :
29, Buckingham Palace-road,
Westminster, S.W. 1,
29th September, 1922. 448

Napier Harbour Board, New ZEALAND.
TENDERS are INVITED for the SUPPLY and DELIVERY of 280 TONS MILD STEEL ROUND BARS.
Specifications may be obtained upon application to W. and A. McARTHUR, Ltd., 18/19, Silk-street, Cripplegate, London, E.C. 2.
Tenders (by telegraph) to reach New Zealand by 9th inst. 448

PUBLIC NOTICES

The Burma Railways Company, LIMITED.
The Board of Directors of the Burma Railways Company, Limited, are prepared to receive TENDERS for the SUPPLY of :—
(a) 5 ENGINES and TENDERS (Superheated "Mallet" Type).
(b) 266 STEEL TYRES for ENGINES and TENDERS.
(c) 4606 STEEL BOILER TUBES and PIPES for ENGINES.
For each copy of the Specification (a) a fee of £2 will be charged, and for each copy of the Specifications (b) and (c) a fee of 10s. will be charged, which fees are not returnable. Tenders, enclosed in sealed envelopes and endorsed "Tender for Mallet Engines and Tenders," or as the case may be, must be delivered at the Company's Offices not later than Twelve Noon on the following dates :—
(a) Friday, 3rd November, 1922;
(b) and (c) Tuesday, 17th October, 1922.
The Directors do not bind themselves to accept any or the lowest Tenders, and reserve the right to divide the orders.
By Order of the Board,
F. C. FRANKS,
Secretary.
109, Gresham House,
Old Broad-street,
London, E.C. 2.
6th October, 1922. 453

Trowbridge Urban District COUNCIL.
TENDERS FOR MOTOR FIRE ENGINE.
The above Council invite TENDERS for a NEW MOTOR FIRE ENGINE capable of pumping 400 gallons per minute, with alternative prices for (a) a DETACHABLE ESCAPE and (b) EXTENSION LADDERS.
Tenders, with complete specification, illustrations, &c., to be marked "Tender for Motor Fire Engine," and addressed to the undersigned and delivered at the Town Hall, Trowbridge, not later than Saturday, 14th October, 1922.
The Council do not bind themselves to accept the lowest or any Tender.
By Order,
G. T. FLETCHER,
Clerk to the Council.
Town Hall, Trowbridge.
26th September, 1922. 359

State Electricity Commission OF VICTORIA.
TENDERS FOR PLANT.
TENDERS are hereby INVITED for the SUPPLY, DELIVERY, &c., of the following for the Mogwell Power Scheme.
Copies of Tender form and specification will be available on and after 21st September, 1922, upon application to
Agent-General for Victoria,
Melbourne-place, Strand,
London, W.C. 2.
SPECIFICATION No. 208.—BACK-PRESSURE STEAM TURBINE, including ONE 1500 K.W. TURBO-ALTERNATOR with EXHAUST VALVES, EXHAUST PRESSURE REGULATOR, CONTROLLING STEAM ADMISSION, BY-PASS REDUCING VALVES, &c.; steam 250 lb. per square inch, 6300 Fah., exhaust 15 lb. to 45 lb. gauge; Alternator 6600 volts, 3-phase, 50 cycles.
SPECIFICATION No. 217.—WATER-TUBE BOILERS and ACCESSORIES, including :—
SECTION 1.—FOUR BOILERS, 4200 sq. ft. H.S., STEP GRATES, DAMPERS, MOUNTINGS, &c.
SECTION 2.—STRUCTURAL STEEL WORK for BOILER-HOUSE, BUNKERS and TURBINE HOUSE, including FLOOR FRAMING, STAIRS, &c.
SECTION 3.—TURBINE-DRIVEN FEED PUMPS, MAKE-UP PUMPS, COLLECTOR DRUMS, TANKS, METERS, &c.
SECTION 4.—COMPLETE SYSTEM of PIPING, VALVES, &c., for all PLANT.
Both the above specifications cover the supply, delivery, and supervision of erection of complete plant, sections being inseparable.
CHARGE.—£3 3s. for the first two copies of Tender form, conditions of contract, and specification complete. These charges will be returned on receipt of a bona fide Tender. A third copy and any further copies will be supplied for the sum of £1 1s. each.
PRELIMINARY DEPOSIT.—A preliminary deposit of £50 is to be lodged with Tender in each instance.
The specifications may be inspected at the above-mentioned office.
The Commission does not bind itself to accept the lowest or any Tender.
Tenders, on the prescribed forms, properly endorsed and addressed, must be delivered to the undersigned in Melbourne not later than 5 p.m. (in the case of Specification No. 208), 31st January, 1923, and in the case of Specification 217, 15th January, 1923.
R. LIDDELOW, Secretary,
State Electricity Commission of Victoria.
304 Melbourne, Victoria, Australia.

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PUBLIC NOTICES

M.A.B.—The Board Invite APPLICATIONS for the APPOINTMENT of a 2nd Class DRAUGHTSMAN at the Mead Works, Carnwath-road, Fulham, S.W. 6 (Repair Works for Motor Vehicles). Salary £150 by £10 to £160 plus Civil Service bonus, at present £100 12s. 2d., on the commencing salary. Minimum age 25 years, maximum 35. —For application form, with full particulars, apply (enclosing stamped addressed envelope) to the ACTING CLERK to the BOARD, Victoria Embankment, London, E.C. 4. Completed forms to be returned by 12th October, 1922. 434

The Sudan Government Railways REQUIRE the SERVICES of a DISTRICT LOCOMOTIVE SUPERINTENDENT. Age 28/32, preferably single. Candidates should have been trained on British railway or in a locomotive builders' works, and should have good knowledge of the working of a locomotive department. A.M.I.C.E. degree desirable. Commencing salary £416, rising to £1000 per annum eventually. Temporary war bonus. Strict medical examination.—Apply by letter to CONSULTING and MECHANICAL ENGINEER, Sudan Govt. Railways and Steamers, 5, Northumberland-avenue, W.C. 2. 454

SITUATIONS OPEN

WANTED by Blast-furnace Owners in Midlands, GENTLEMAN or FIRM for Sale of Pig Iron, Manchester and other districts.—Address, stating experience and salary required, 344, The Engineer Office. 344 A

WANTED, CONTRACTORS' AGENT, with Wide knowledge of Steam Navvy Excavation, for foreign contract.—Apply, with full particulars of experience, to Box 94, c/o Dawson's, 17, Craven-street, London, W.C. 2. 450 A

AN Important FIRM of LOCOMOTIVE MANUFACTURERS REQUIRES for their London office a young, energetic, capable ENGINEER, whose chief duties will be to call upon Railway Companies, Consulting Engineers and Merchants; public school man preferred.—Write, stating age, experience, present employ, business connections, salary required, and photograph, in strictest confidence (all papers will be returned), to S. T., c/o Street's, 29, Cornhill, E.C. 3. 442 A

ASSISTANT ENGINEER WANTED by Canal Company; must be a good Surveyor and have a knowledge of Engineering Work. Commencing salary £200 per annum.—Address, stating age and experience, with references, 381, The Engineer Office. 381 A

DRAWING-OFFICE MATERIALS.—LONDON FIRM (non-combine) WISH to HEAR from GENTLEMAN calling on Engineering Firms, &c. Partnership basis to right man.—Address, P6193, The Engineer Office. P6193 A

ENGINEER REQUIRED to SUPERINTEND REPAIR and BODY BUILDING SHOPS at Redhill, Surrey, and to Assist in the Purchasing and Erection of all kinds of Machinery for Sand and Gravel Pits. Preference given to one having shop experience in railway works, also motor lorry works, both petrol and steam.—Apply by letter only, stating degrees, references, experience, age and salary required, to the Secretary, HALL and CO., Ltd., Victoria Wharf, Croydon. 433 A

FIRST-CLASS TRAVELLER REQUIRED by Firm of Engineers opening an office in Liverpool. Must have good connection amongst shipping engineers in Liverpool and district and amongst firms in Lancashire and Yorkshire. State experience and lines travelled in, also salary required.—Address, 432, The Engineer Office. 432 A

REPRESENTATIVE WANTED in London for a Boilermaking Firm; capable man, likely to secure boiler orders, tanks and general wrought iron and steel work.—Address, stating experience and terms, P6132, The Engineer Office. P6132 A

WANTED, Good and Experienced DRAUGHTSMAN for probable temporary position; the chief duty would be to produce fully detailed works plan. If suitable, length of service may be extended to probable permanency.—Apply, JOHN BUTLER and CO., Ltd., Stanningley Ironworks, near Leeds. 460 A

FIRST-CLASS DRAUGHTSMAN REQUIRED by old-established Crane Firm in the North of England. One experienced in the Design of Steam and Electric Cranes. State age, experience, and salary. Replies treated confidentially.—Address, 348, The Engineer Office. 348 A

FIRST-CLASS SENIOR DRAUGHTSMAN REQUIRED IMMEDIATELY for Aircraft; good technical and practical knowledge essential.—Apply, giving full particulars of experience and salary, to WESTLAND AIRCRAFT WORKS (Dragon of Peters, Ltd.), Yeovil. 474 A

HEAVY VEHICLE LEADING DRAUGHTSMAN REQUIRED AT ONCE; some Electrical or Petrol-electric experience an advantage.—Reply, stating wages required, to Box 166, T. B. Browne's Advertising Offices, 163, Queen Victoria-street, E.C. 4 477 A

REQUIRED, a TEMPORARY DRAUGHTSMAN, used to Design of Centrifugal Pumps.—Address in writing, giving experience, P6209, The Engineer Office. P6209 A

FOREMAN (Machine and Erecting Shop), Accustomed to Colliery Engineering, Haulages, Winding Engines, Repetition Work, and Rate Fixing. None but competent men giving fullest particulars, age and wages need apply.—Address, 356, The Engineer Office. 356 A

SITUATIONS WANTED

WANTED, OPENING for College and Works Trained STUDENT (21), G.I. Mech. E. One presenting ultimately commercial work, London district preferred.—Address, P6178, The Engineer Office. P6178 B

A COMPANY SECRETARY and COMMERCIAL MANAGER, with wide experience in modern engineering, machine tools and small tools trades, SEEKS similar POST with progressive firm requiring a capable man experienced in company secretarial work and control of commercial side of large business. Efficient organiser, enterprising and energetic.—Address, 473, The Engineer Office. 473 B

A.M.I.N.A. (35), Experienced Ship and Engine Surveyor, Technical, Business and Works Manager, expert in Diesel and Internal Combustion engines, REQUIRES ENGAGEMENT, any capacity, marine or otherwise.—Address, P6177, The Engineer Office. P6177 B

ABROAD; U.S.A. Preferred. Trained ENGINEER DESIRES POSITION; 10 years' general experience, home and abroad; practical, technical, commercial; good knowledge Spanish and French.—Address, P6117, The Engineer Office. P6117 B

ANY FIRM, Interested in the Invention, Design, and Patenting of Mechanical Appliances, that can profitably UTILISE the SERVICES of an ENGINEER SPECIALIST of proved ability and long experience in the above fields, is invited to write to P6164, The Engineer Office. P6164 B

AS WORKS MANAGER, Thoroughly Practical, Well-educated Engineer, sound shop and D.O. experience, loco., steam, general engineering, millwrighting, ironfoundry and repair work. Past 22 years successful control of labour as foreman and works manager.—Address, P6065, The Engineer Office. P6065 B

OPPORTUNITY OFFERED.

Firm of Manufacturing Engineers, opening an office in Liverpool, and employing salaried travellers, are prepared to Represent a few other Manufacturers of repute, in Northern Counties, on a guaranteed commission basis, in following lines:—Shipyard Tools, Fittings, and Appliances, Boilers, Electric Motors, Steam Appliances and Packings, Steel and Iron, and any good specialities.

These firms requiring real LIVE Representation on an economical basis should not miss this opportunity, as the Office will be under the control of one of the Directors of the firm, who has had 12 years' experience in Selling Organisation.

Address, in first instance, 431, The Engineer Office. 431

Liquidation of Sequestered German Property in France.

By order of the President of the French Civil Court of the Department of the Seine.

THE VERY IMPORTANT MANUFACTORY OF AUTOMOBILE TYRES,

WELL KNOWN AS

SOCIÉTÉ ANONYME "CONTINENTAL" Tyre, Ltd.,

des Caoutchoucs Manufactures,

Will be SOLD by PUBLIC AUCTION, at the PALAIS DE JUSTICE OF PARIS,

ON TUESDAY, NOVEMBER 14TH, 1922, AT 2 P.M.

Reduced upset price: 4,500,000 Francs.

Cash deposit required for bidding: 225,000 Francs.

The sale comprises various rubber supplies, IMPORTANT MACHINERY and MATERIALS for the manufacture of solid rubber tyres, and tyres for bicycles and motorcycles, inner tubes for autos; as well as the LARGE FACTORY.

Located 104 to 112, Quai de Clichy à *Clichy* (Seine), *on the outskirts of Paris*—occupying a total area of 19,250 square metres (acres 4·76), of which 7,500 *square metres* (acres 1·85) *are covered buildings*. WITH IMMEDIATE VACANT POSSESSION.

For information apply, or write to, Monsieur PAUL DESFRESNE, Liquidator, Administrateur Judiciaire de la Société "*Continental*," 14, Rue Saguier, PARIS.

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SITUATIONS WANTED (continued)

BUYER.—The MANAGER of a Large Engineering Works Purchasing Dept., who has an exceptionally wide knowledge of the markets of the country, DESIRES to NEGOTIATE NEW APPOINTMENT.—Write, Z. M. 614, c/o Deacon's, Leadenhall-st., E.C. 467 B

ENGINEER, A.M.I.C.E., M.I.M.E., Public School, age 36, last ten years in responsible executive position, DESIRES CHANGE. Exceptional practical, technical and commercial experience and ability in general and constructional engineering and works maintenance. Thoroughly accustomed control and organisation large works and office staff.—Address, P6205, The Engineer Office. P6205 B

ENGINEER, A.M.I.C.E., with 10 Years' Experience and excellent references, SHORTLY at LIBERTY to ACCEPT POST where prospects good.—Address, P6200, The Engineer Office. P6200 B

ENGINEER, Late Manager of Small London Works, with good general engineering experience, SEEKS any responsible POST, anywhere. Moderate salary; good references.—Address, P6213, The Engineer Office. P6213 B

ENGINEER, to Take Charge of Heavy Oil or Gas Engines; London district preferred. Varied experience in shops, outside erection and repairs. At present with leading makers.—Address, P6212, The Engineer Office. P6212 B

ENGINEER (25), B.Sc. Hons. Eng., Grad. I.E.E., 4 years power station, 2 years research, DESIRES APPOINTMENT as Assistant in Research, manufacturing firm, power station, or traction.—Address, P6194, The Engineer Office. P6194 B

ENGINEERS!—Now is the Time of Reduced Wages. I have 8 years' mech. exp., tech. shops, D.O. What offers for my services?—24, Ashdown-road, Kingston-on-Thames. P6182 B

IMPULSE TURBINES.—GENTLEMAN, with wide and unique experience in the design, construction and testing of above, with leading makers, is OPEN for CHANGE, where real live man would be appreciated; DESIGNER or MANAGER. Firms of standing only. Moderate initial salary.

Address, P6218, The Engineer Office. P6218 B

LATE INDIAN GOVERNMENT OFFICIAL DISENGAGED owing to "Indianisation" scheme. Qualified mechanical engineer, open for engagement early in 1923. Age 34, A.M.I. Mech. E., Englishman, married, public school and workshop trained; 12 years' commercial and Government experience in England and India. Well connected and recommended. Willing to go abroad, preferably Colonies.—Reply to "BRITISHER," c/o King, King and Co., P.O Box 110, Bombay, India. P6197 B

MECH. ENGINEER (35), Recently Returned After 10 years with large mining firm in the East, DESIRES APPOINTMENT. First-class B. of T. certificate. Experience includes erection and maintenance of Diesel and semi-Diesel and steam engines, water-tube boilers and general mining machinery; some knowledge of electricity.—Address, P6216, The Engineer Office. P6216 B

METALLURGICAL CHEMIST (34), Expert Analyst, alloys, refractories, iron, steel, &c., with exper. as assist. manager on Siemens plant (acid and basic), not afraid of work, DESIRES POST; good refs.—Address, P6211, The Engineer Office. P6211 B

REFRACTORIES, FURNACES.—GENTLEMAN WISHES to OFFER to manufacturers of above his SERVICES as REPRESENTATIVE (technical and sales). Nine years connected with iron, steel and glass trades.—Z. B. 79, care Deacon's, Leadenhall-street, E.C. 466 B

THE PROBLEM SOLVED.—How to Obtain, Inexpensively, the SERVICES of a qualified ENGINEER or DRAUGHTSMAN and the best expert information.—Address, mentioning requirements, P6186, The Engineer Office. P6186 B

WORKS ENGINEER, Excellent Experience in Factory reorganisation, plant installation and maintenance, SEEKS APPOINTMENT as Chief or Assistant; good organiser, excellent references.—Address, P6208, The Engineer Office. P6208 B

ENGINEER DRAUGHTSMAN, Age 37, SEEKS ENGAGEMENT; 12 years D.O. and 8 years shops. Leading draughtsman, good technical knowledge, motor vehicles, general engineering and jig and tool design. London district.—Address, P6220, The Engineer Office. P6220 B

MECHANICAL DRAUGHTSMAN, with Wide Experience in the design and lay-out of various industrial plants, power station design, and general engineering, DESIRES SITUATION; London or South Coast.—Address, P6202, The Engineer Office. P6202 B

SITUATIONS WANTED (continued)

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For continuation of Small Advertisements see page 3.

SEPTEMBER.

Labour in France.

Several events during the past month have revealed the uncompromising attitude of workmen in France towards any attempt to induce them to make any temporary sacrifices for their own ultimate benefit, as well as for the benefit of industry generally. The engineering and other trades have now arrived at a stage when business can only be done by bringing down production costs. This is possible by lowering wages or increasing the hours of work, and as neither alternative is acceptable to the men, it is feared that there will be a great deal of trouble before the conditions settle down on a satisfactory basis. The strike in the engineering industries at Havre against a reduction in wages has been marked by violent Communist agitation, and as the three months' struggle appears as far off from settlement as ever, the Chamber of Commerce is investigating the possibility of bringing down living costs to a level that will permit of the men accepting the lower wages offered. The seamen's strike against the suppression of the eight hours' day is one of the most reckless and certainly the most harmful to the country of recent years. The only gratifying feature is the acceptance by the railwaymen of the additional hours which will permit of the companies reducing considerably the number of men, and thereby realising important economies, but it is hardly to be expected that the coalowners and some other workers will show the same spirit of conciliation when the time comes for settling the question of wages adjustment. The resistance offered by the men is strengthened by the labour scarcity, which has been brought about very largely by the application of the eight hours' day and also by the drafting of workers, by the offer of high wages, into the devastated areas.

Buffer Stop Collisions on Railways.

The reports to the Ministry of Transport on two buffer stop collisions on railways were issued during the month. One related to a mishap at Ealing on July 11th, and the other to that at Liverpool-street on July 27th. Collisions with buffer stops are rarely fatal, but they furnish a very large number of claims for injury. For instance, out of 690 passengers injured in train accidents last year, 130 met with their mishaps in buffer stop collisions. Again, out of the 16 passengers in the Central London train at Ealing, 9 were hurt, and of the eight hundred in the Great Eastern train at Liverpool-street, 77 complained of shock or injury. The high proportion of injuries in this class of accident—as compared with those sustained in collisions between trains—is due to the fact that a large number of the passengers are standing, waiting to alight, and are thrown off their feet. It is of interest to note in connection with the two particular cases before us that there was an extra motorman in the cab in the first accident and a locomotive inspector on the footplate in the other. In both instances the drivers committed an error of judgment. We know, because it was so stated in Major Hall's report, that the driver at Liverpool-street wanted to stop exactly at the water column, and so was almost as anxious not to stop short as to overshoot the mark. The man at Ealing had a six-car train, and would therefore have, we assume, to draw well down the platform. Is it not likely that both men wanted to "show off" to the other men how well they handled their trains? We do not make this suggestion in disapproval, but in an effort to explain how these errors of judgment came about.

The Ebbw Vale Dispute.

On September 22nd it was announced that the collieries and coke ovens of the Ebbw Vale Steel, Iron and Coal Company, Limited, would be closed down on account of the strike of the miners over differences of interpretation of the price list award of Dr. William Galloway. The shutting down of the coke ovens automatically led to the drawing of fires at the iron and steel works, and altogether some 15,000 men were involved in the dispute; moreover, as the gas supply is derived from the coke oven plant, the town was placed in darkness. From the statement issued on behalf of the company on Wednesday, the 27th, it appears that for the past twelve months the Ebbw Vale collieries have been working on a temporary agreement, pending the decision of the arbitrator, Dr. Galloway, in the matter of price lists, which award was given in July last. Conferences between the management and Mr. Evan Davies, representing the men, took place on various occasions, and on one occasion in August the collieries were stopped and a stoppage of the coke-oven plant was also threatened. On Saturday, August 26th, the directors of the company met Mr. Davies, who was informed that the grievances complained of would be diligently considered if put before Mr. Hann, the general manager, and failing agreement, Mr. Davies could have recourse to the Disputes Committee of the Conciliation Board which had full powers to deal with such matters. At a later date negotiations were broken off, and subsequent events led to the withdrawal of the men from the collieries and by-product plant on September 21st. It is now announced that representatives of the company and of the men met Dr. William Galloway at the Cardiff offices of the South Wales Miners' Federation on Monday last, when the arbitrator explained the application of his award. He decided that the three months' interval expiring on November 1st, 1922, was intended to enable the parties after mutual consultation to arrive at an agreement as to what allowances or proportions of the allowances paid at present are to continue after November 1st, 1922; and that the question of allowances of all kinds is to be discussed between the parties, from the point of view of affording the workmen, where the circumstances justify it, such allowances as will as far as possible place them in as good a position as to their earning power as their fellow-workmen in surrounding districts, and so that such alowances shall be in all respects subject to the usual practice of the South Wales coalfield. The terms of this decision uphold in principle the men's contention that the allowances for special places were to be continued. As yet no intimation has been given as to the date on which work will be resumed. The company is faced with a new difficulty as a result of the decision of a delegate conference of the South Wales Miners' Federation on Saturday last to hand in notices on the non-unionist question on October 23rd.

The Battleship "France."

The loss of the battleship France while passing on a clear night through the Teignouse Channel into Quiberon Bay, has revealed omissions in the marine charts which, though slight in themselves, have proved that disaster is always lurking on the Brittany coast. It is admitted that the battleship was proceeding along the extreme edge of the recognised course, when it struck a solitary rock on the sea bed, which ripped open the hull, and the France turned over and sank in a few minutes. At first the public was sceptical about the existence of an unknown obstacle in a frequented passage, but divers discovered the rock, of which the top had been broken off by the impact. The hydrographical department explained that it was almost impossible by soundings to be sure of locating sunken rocks, and it was announced that in future hawsers would be drawn along the bottom, the result being that another dangerous rock has been discovered in the Teignouse Channel. In consequence of this disaster, the hydrographical service is to be entirely reorganised, and a minute verification of the charts is to be started upon immediately. Meanwhile, there is little hope of refloating the battleship. It lies in a channel where the currents are so strong that divers can only work occasionally, and the cost of refloating and fitting out the battleship would be far too heavy to permit of the attempt being made.

The Circuit of Britain Air Race.

Starting from Waddon Aerodrome, Croydon, on the morning of the 8th, twenty-one aeroplanes set off at handicap intervals on a flight to Glasgow, *viâ* Birmingham and Newcastle, and back, *viâ* Manchester and Bristol, in competition for a Gold Cup presented by his Majesty the King. The majority of the machines entered for the contest were of fairly old design, some of them, including the winner, being, in fact, wartime productions. Four of the machines failed to reach Birmingham, two more gave up before reaching Newcastle, and two others dropped out on the way to Glasgow. The remaining thirteen succeeded in flying to Manchester, but between Manchester and Bristol two more withdrew from the race. All the eleven machines which left Bristol returned safely to Croydon, the de Havilland 4A machine, belonging to the Instone Air Line and piloted by Mr. F. L. Barnard being first, with the Martinsyde F6 machine, flown by Mr. F. P. Raynham, a close second. The winner's total net flying time was 6 h. 32 min. 50 sec. Some disappointment and criticism were expressed at the fact that only just half the machines entered for the race succeeded in getting round the course, but on the whole the test was a fairly severe one for the pilots, the machines and the engines. That it should have been accomplished without serious mishap to any of the competitors is a circumstance which should certainly not be overlooked when criticising the results of the competition. At the same time, it cannot be denied that as an exhibition of the trustworthiness of flying it lacked something of conviction.

Commercial Propaganda.

The French Government has discovered an elegant way out of the disarmament difficulty by converting battle-cruisers into floating libraries of commercial literature with conference and kinematograph halls, and everything necessary for making known to prospective buyers abroad the industrial resources of France. It is much more economical than chartering and fitting out vessels at the expense of exhibitors who have to pay for space. Vessels of war must be kept more or less in commission, and as the expenses are always running, it is just as well, in the opinion of our French friends, that they should be productive. To ourselves, accustomed to regard the Navy as the bulwark of freedom, the idea of sending out units to distant parts of the world to look for orders appears a little disconcerting. In some foreign countries it seems natural to make use of war vessels as instruments of propaganda, and it is quite conceivable that the battle-cruisers Jules Michelet and Victor Hugo will render an excellent service during the nine months' cruise in which they will visit Australia, Japan, China and India. Loaded with catalogues and samples, under the direction of a commercial expert, they will carry out their mission under more imposing conditions than would be possible with merchant vessels, and will prove a greater attraction to people in the ports visited. Everyone boarding the cruisers will see evidence of what France can supply in the way of commercial and industrial products. The names of the vessels themselves convey an idea of the eminently peaceful character of the mission. In view of this extended utility of the navy, we find ourselves haunted by the awful thought that in future naval architects may be called upon to provide showrooms and commercial offices in the designs of battleships!

Unemployment.

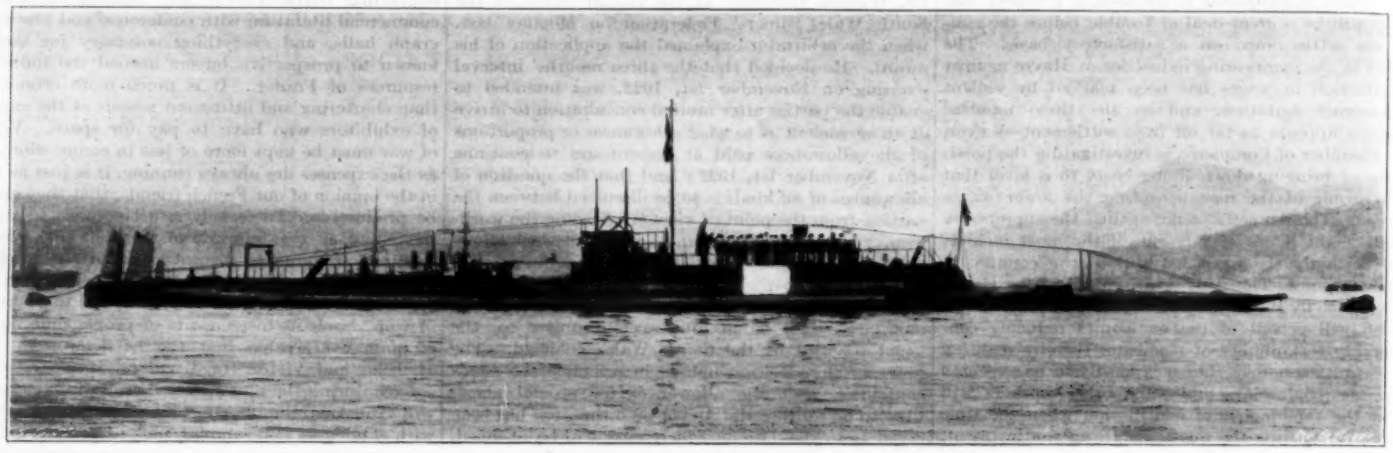
There is always seasonal unemployment during the winter months, and it is feared that, coming as it will on top of a degree of unemployment already excessively high, great distress will result. In normal times, if 8 or 9 per cent. of the industrial population is out of work, there is much suffering, and as at the present time unemployment approaches double that figure, the condition may be imagined. As is well known, a Cabinet Committee is inquiring into the whole problem, and will present its scheme when Parliament reassembles. Part of the report is no doubt foreshadowed in the undertakings for road improvements which are before the Ministry of Transport, and which have been under discussion during the past month. It is understood that, whilst the programme is not yet complete, the Ministry has under consideration the expenditure of something like seven million pounds sterling on road improvements in many parts of Great Britain. Amongst these projects it is of interest to note that the construction of a new road between Liverpool and Manchester at a cost of three million pounds is under examination. It would seem appropriate that the two cities which were the first—1830—to be united by a railway should be also the first to be connected by a reformed road nearly a century after their marriage by rail. It is understood that up to the present time about one million and a-half pounds have been voted by the Ministry of Transport for road works.

The Price of Petrol.

The outstanding event of the month in connection with motor traction was the very substantial reduction in the price of petrol, said to be due to the fall in American prices and shipping freights. The reduction of 5½d. per gallon, or approximately one-sixth of the fuel bill, will be welcomed alike by the motorist and the motor industry, the latter of which is at present suffering from depression. It cannot fail to have a beneficial effect upon all forms of traction in which the internal combustion engine plays a part. Incidentally, by cheapening road transport, the cost of transport by rail should be reduced and industry generally should benefit.

Japan's Naval Construction Programme.

Since we last wrote on the subject of Japanese naval policy there have been important developments which merit some further comment. In an article published on May 26th we reviewed the principal modifications in the shipbuilding programme brought about by the Washington Treaty, and showed that economic necessity was compelling Japan to proceed with the construction of a fairly large number of so-called "auxiliary combatant craft," the aggregate tonnage of which is not restricted by the Treaty.

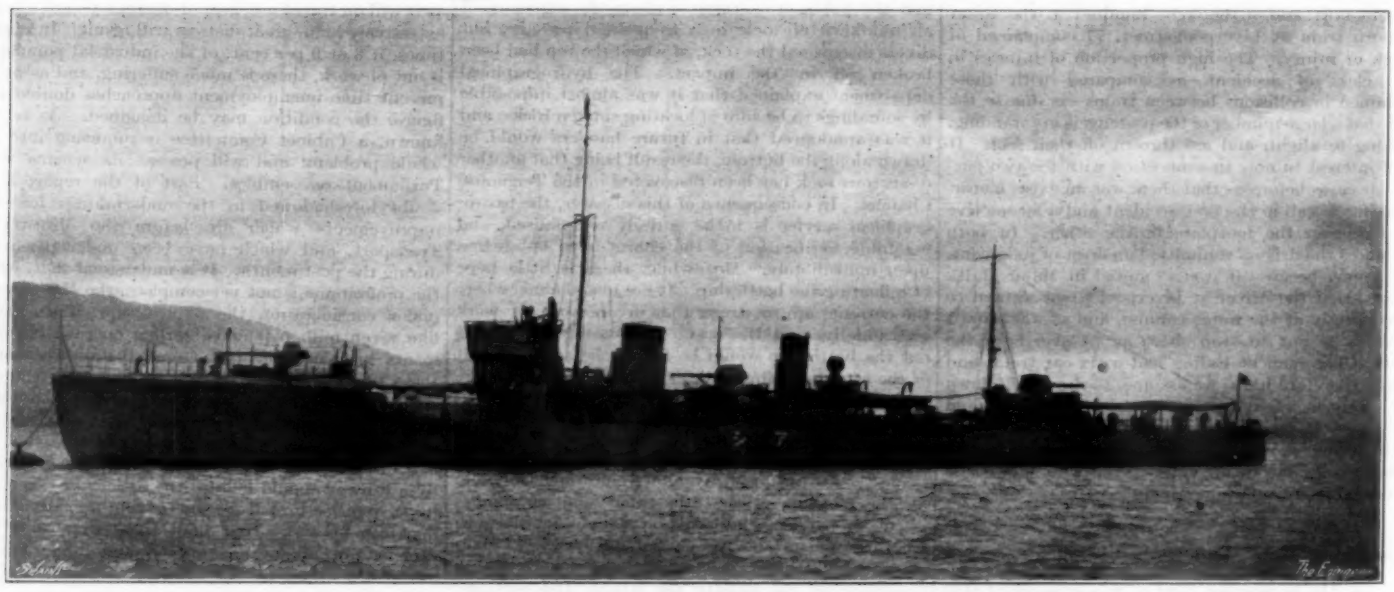


THE JAPANESE SUBMARINE, No. 23

The Imperial Navy Department in Tokyo has now issued a statement explanatory of its shipbuilding plans for the near future. According to this document, there is no truth in the reports circulated abroad, principally in the United States, that a large increase in the number of auxiliary vessels which had been authorised previous to the Conference is meditated. On the contrary, it is stated, the total is actually to be reduced by one cruiser, 13 destroyers and 24 submarines, as compared with the original programme of ships to be completed by the year 1927. At the same time, however, the designs of all remaining vessels have been redrafted on the basis of greater dimensions and power, so that the deletion of the thirty-eight units enumerated signifies a reduction of only 13,935 tons in the total displacement of the pre-Conference programme. It is clear from this that very large additions have been made to the displacement of the surviving vessels, which comprise the following:—Four cruisers of 10,000 tons each; four cruisers of 7000 tons each; 24 destroyers of the first class, with an aggregate of 33,000 tons; and 24 submarines, with a collective displacement of 28,166 tons. It is not stated which of these vessels, if any, have already been laid down, but in any case they are likely to be put in hand as soon as circumstances permit, since they are intended to provide the leading shipyards with employment in place of that which was lost through the cancelling of the capital ships. The four largest cruisers, it is surmised, will be distributed among the leading State and privately owned yards—Kure and Yokosuka in the former category and Kawasaki and Mitsubishi in the latter. One of the 7000-ton ships may be built at Sasebo Arsenal and the other three by contract.* If precedent is followed, the majority of the destroyers and submarines will also be constructed in private establishments.

Four of the new cruisers, it will be observed, are to be of the maximum displacement which the Washington Treaty specifies for ships of this type. They will therefore be the largest modern cruising ships to be found in any navy up to the present, surpassing our "Raleigh" class by 250 tons, and showing an excess of no less than 4400 tons over the largest cruisers hitherto built in Japan. As they are expected to embody very high speed, a large fuel capacity, special features of protection, and a main armament of the heaviest calibre permitted by the Treaty, viz., 8in. guns, particulars of their design will be awaited with more than ordinary interest. As regards the 7000-ton cruisers, at least one vessel of this displacement is known to have been laid down recently, and it is probable, though not certain, that this ship is included in the quartet embraced by the modified programme. As will appear later, Japanese constructors have been singularly successful with their recent light cruiser designs, which compare very favourably with the best cruising ships now under foreign flags. A total of 33,000 tons for the 24 new destroyers gives an average of approximately 1375 tons per boat, as compared with the 1345 tons of the latest first-class Japanese destroyers to be completed. The lower figure corresponds more or less to the displacement of our "Admiralty V." class, which have machinery of 27,000 shaft horse-power for a speed of 34 knots. The Japanese 1345-ton boats, however, are credited with 38,500 shaft horse-power, or only 1500 units less than our "Admiralty" type flotilla leaders, which displace 1800 tons. Evidently, therefore, the new Japanese destroyers are capable of developing very high speeds. The first-class boats are now armed with four 4.7in. guns, two anti-aircraft machine guns, and six torpedo tubes, but in the latest design a fifth 4.7in. gun is said to be provided for.

Turning to the submarines of the amended programme, the average displacement of the 24 new boats works out at 1173 tons, but it is not expected that the entire group will be of uniform design. As far back as 1920 Japanese plans were got out for several types of large cruising submersibles, ranging in surface displacement from 1500 to 2500 tons, with a maximum speed of 18 knots, and in the course of last year the first 1500-ton boats were laid down. Their displacement is almost double that of the earlier boats, which are 740 tons in surface trim and 1100 submerged. Problems of submarine design receive the most careful attention in Japan, where a continuous effort is made to assimilate the best features of foreign, including German, construction into the basic design which has been evolved to meet special Japanese requirements. So far as can be ascertained, the manufacture of large-powered Diesel engines for submarine propulsion is still imposing a severe strain on the national industry, and it has been found necessary to enlist the aid of both British and continental firms to meet the demand for such machinery. Details of these orders are not yet available, but it is understood that the first boats of the new 1500-ton type will be equipped with Diesel engines of European manufacture. In all other respects, however, the modern Japanese submarine is of purely national conception. It differs from the prevailing foreign types by reason of its large reserve of buoyancy, which is nearly 50 per cent. This is in accordance with German practice, while contemporary boats of British, American and French design have a much smaller reserve of buoyancy. The inner hull of the Japanese boat is small, but it is enclosed in a very large outer hull, with the result that the inter-skin spaces are exceptionally large. By this system the water ballast tanks and the oil storage spaces are considerably enlarged, the margin of safety is increased and the cruising endurance prolonged. In the opinion of Japanese naval officers, their submarines, though perhaps rather less speedy than foreign boats of similar tonnage, are better adapted to general war service, especially in the waters of the Pacific Ocean.



THE JAPANESE DESTROYER ASHI

* Since the above was written a despatch from Tokyo, dated August 19th, states that the construction of two 7500-ton cruisers will be begun shortly. They are to be named respectively Kinugasa and Furutori.

The exact number of submarines completed, built and projected for the Japanese Navy cannot be stated with certainty, information on this point being vague and contradictory. In Parliamentary Paper No. 123 —"Return showing the Fleets of the British Empire and Foreign Countries"—which was issued recently, 24 boats are shown as built, exclusive of eight omitted on the score of obsolescence, and 32 as building, but there is no means of telling whether any of the 24 boats of the modified programme are included in the last-named figure. According to Japanese Press reports, quoted in *La Revue Maritime*, the following fifteen boats were completed during last year:—Nos. 38, 39, 40 and 41 at Yokosuka; Nos. 34, 35 and 36 at Kure; Nos. 29, 30, 31, 32 and 33 at Kobe; Nos. 43 and 45 at Sasebo; and No. 42 at Maizuru. No. 44 was launched on November 29th, 1921, and in the same month the keel of No. 62 was laid at Sasebo. This year's list of launches will bring the number of boats afloat well into the sixties, though allowance must, of course, be made for the considerable time which is occupied in fitting out a boat for sea after she has left the slip. As submarines increase in dimensions and complexity of internal equipment, the period required for this work grows proportionately longer; particularly in Japan, where the boats appear to be launched at the earliest possible stage of construction in order to clear the slips for new keels. Taking 60 as the number of the last boat authorised before the modified programme was adopted, and adding the 24 new boats specified in that measure, we obtain a gross total of 84 submarines. This, however, includes 13 early boats which are too small to be effective outside coastal waters, and should therefore be omitted from any estimate of strength in ocean-going craft. The total is thus reduced to 71 boats, as compared with the 58 boats of which the British submarine flotilla will consist when the deletions ordered by the Admiralty during the current financial year have been made. The American total is very much larger, but will be found on analysis to include a great number of boats of small tonnage and restricted endurance. Of large ocean-going submarines, comparable with those now built or being built for Japan, the United States has only 56 completed or building. It will thus be seen that Japan is in a far stronger and better position with regard to submarine strength than a cursory glance at the comparative tables would suggest.

To the large selection of illustrations of notable vessels of the Japanese Navy which we published as a special Supplement to our issue of November 25th, 1921, we are now able to add—herewith and on page 351—five further views of recent additions to the sea power of the Island Empire. Special interest attaches to the battleship Mutsu, which formed the subject of so much discussion at the Washington Conference. It will be recalled that under the original American scheme of limitation, this vessel was to be scrapped, a proposal to which the Japanese delegates took strong exception, mainly on the ground that she was practically completed before the Conference met. After weeks of debate, it was finally agreed that the Mutsu should be retained, corresponding adjustments being made in the ratios of capital ship tonnage allotted to Japan, the United States and the British Empire respectively. As a result of this compromise, Great Britain was empowered to lay down two new 35,000-ton battleships. It will therefore be seen that Japan's successful claim to keep the Mutsu had far-reaching effects. Until our new vessels are afloat, this ship and her sister, the Nagato, will continue to represent the heaviest type of battleship in the world, though their individual displacement is 7400 tons less than that of the British battle-cruiser Hood. Laid down at Yokosuka Dockyard on June 1st, 1918, the Mutsu was launched on May 31st, 1920, and went into commission during December, 1921. Her leading characteristics are:—Length between perpendiculars, 660ft. 7in.; length over all, 698ft. 6in.; breadth, 95ft.; mean draught of water, 30ft.; displacement, 33,800 tons. The lines of the hull, moulded with an eye to speed, are somewhat finer than those of the latest foreign battleships. There is no external bulge, but an elaborate system of subdivision in association with armoured bulkheads placed well back from the outer plating is believed by her designers to make the ship reasonably invulnerable to underwater attack. The motive power is supplied by geared turbines of 46,000 shaft horse-power. There is no definite information as to the number or type of the boilers. The speed of the Mutsu on the measured mile is returned as 23.4 knots, but the ship is said to have attained higher speeds than this in her full-power endurance trials.

As it is not the custom of the Japanese authorities to disclose details of armour protection in their modern ships, the thickness of the Mutsu's side, deck and turret armour can only be surmised, but according to the percentage of other weights to total displacement, it would appear to be very massive. The main armament consists of eight 16in. 45-calibre guns, mounted in four turrets on the centre line of the ship. These weapons were constructed at the Muroran Ironworks, and the breech mechanism at Kure Arsenal. Each gun weighs 112 tons unmounted, and throws a projectile of about 2200 lb. The mountings permit of an elevation up to 25 deg. or 30 deg. Twenty 5.5in. quick-firing guns are disposed in casemates, the position of this secondary armament being clearly visible in the illustration. There are besides four 12-pounder anti-aircraft guns, four above-water torpedo tubes, and four submerged tubes. As in the Nagato, the foremast is a gigantic heptapod structure, supporting searchlight platforms, control tops, and director towers for the main and secondary armament. Great rigidity is claimed for this form of mast, as well as immunity from destruction by shell fire; but the weight involved must be serious, and the large area of target it offers is a further drawback. The opening visible at the stern of the ship leads out of the admiral's quarters, and presumably takes the place of the overhanging stern-walk fitted in some earlier ships, which was liable to be flooded in heavy weather or when the ship was steaming at full speed. With the commissioning of the Mutsu, Japanese capital ship construction is to be suspended for a term of ten years, conformably with the Limitation Treaty. The 40,100-ton battleships Kaga and Tosa launched last year are to be used as target ships and eventually broken up; while the battle-cruisers Amagi and Akagi, still on the stocks, have been re-designed as aircraft carriers, each displacing 26,000 tons.

The light cruiser Oh-i is one of a very numerous class of ships which have proved an unqualified success. Her sister vessels are the Kuma, Tama, Kitakami, Kiso, Nagara, and, with slight modifications, the Natori, Isudzu, Yura, Kinu, Ayase, Otonase, Minase, Abukuma. The Oh-i herself was begun at the Kawasaki Yard, Kobe, in November, 1919, launched the following July, and completed last autumn. The first ships of the class were begun in 1918, and the last unit, Abukuma, is still on the stocks. The principal dimensions of Oh-i are as follows:—Length between perpendiculars, 500ft.; length over all, 535ft.; breadth, 46ft. 9in.; mean draught of water, 15ft. 9in.; normal displacement, 5500 tons. She has geared turbines of Parsons type, taking steam from fourteen boilers, mainly oil-fired, and developing 90,000 shaft horse-power. We understand that the designed speed of 33 knots has been exceeded by every ship of this class which has hitherto made her trials, and that in at least one case the remarkable velocity of 34 knots was achieved. This is easily a world's record for light cruiser speed, and one that reflects the utmost credit on Japanese engineers and engineering. Our own light cruisers of the "E" class, of 7600 tons, are expected to develop 80,000 shaft horse-power, equivalent to 33 knots when in light condition, and the American "Omahas," of 7500 tons, are designed for 90,000 shaft horse-power and 33.7 knots; but meanwhile the Japanese ships have actually exceeded both these velocities. The Oh-i and others of her type are protected by a partial belt of high-tensile steel, reinforced by an armour deck, 2½in. thick at the extremities. They are armed with seven 5.5in. quick-firing guns, throwing an 82 lb. shell. Two of these pieces are placed tandem-wise on the forecastle, one is on each beam abreast the foremast, and the remaining three are on the centre line in the after part of the ship. While this disposition limits the direct-ahead fire to three guns and the stern fire to one gun, on the other hand, it permits of a powerful concentration of fire on the bow or quarter, and the fact that it has been adhered to in so many ships is evidence of its tactical advantages. There are eight 21in. deck torpedo tubes mounted in pairs, two on each side at the break of the forecastle, and two in similar positions abaft the aftermost funnel. Two 12-pounder guns are carried for aircraft attack. As will be seen from the illustration, all the guns have an excellent command, thanks to the high freeboard of the ship and the mounting of the after weapons on the superstructure deck.

These light cruisers are reported to be splendid seaboats, and able to work their armament with effect in conditions of weather which would severely handicap low-lying craft, such as our "C" and "D" vessels. A squadron consisting of the Oh-i, Kiso, Kitakami, and Tama, escorted the Prince of Wales in H.M.S. Renown from Hong Kong to Yokohama, and their admirable behaviour in the heavy weather which was encountered during the passage was observed with great interest from the British ship. According to the Admiralty Return, mentioned above, Japan now has 25 effective light cruisers built and building, all but four of which date from 1918. If, therefore, the eight ships of the post-Conference programme are all additional to these, the establishment will eventually reach 33 ships or, deducting the four older vessels, 29 light cruisers, the slowest of which has a trial speed of 33 knots. Unless present programmes are considerably amplified, no other navy will be able to match this remarkable fleet of cruising ships.

Steady progress continues to be made in the development of the destroyer flotillas. At the beginning of the year the effective boats in service numbered 59, the majority of which are of post-war design; and 28 were under construction. As a number of additional boats have been commenced during the year, the present position is approximately as follows:—Built, 65; being built, 30. To these must be added the 24 destroyers to be laid down in accordance with the amended programme, the completion of which will bring the establishment up to 55 first-class boats and 56 second-class, the former with displacements ranging from 1085 to 1400 tons, and the latter from 600 to 850 tons. As in all other types of warships recently designed in Japan, the new destroyers exhibit a high degree of tactical efficiency in proportion to their size. The latest design of which we have cognisance is that of the "Shiokaze" class, launched in 1920, and to which belongs the Hakaze, of which an illustration is given. The chief dimensions of this class are:—Length between perpendiculars, 320ft.; length over all, 336½ft.; breadth, 29½ft.; mean draught of water, 9½ft. Machinery:—Geared turbines drawing steam from four oil-fired boilers, and developing 38,500 shaft horse-power for a speed of 34 knots. The armament comprises four 4.7in. 45-pounder quick-firing guns, two anti-aircraft "pom-poms," and six 21in. torpedo tubes mounted in pairs. In the later boats, it is anticipated, the extra displacement will be utilised to increase the fuel capacity, and the gun armament may be strengthened. Our illustration of the Ashi typifies the latest group of second-class destroyers to be completed. The Ashi was launched in September, 1921, and commissioned about four months ago. She is 275½ft. long between perpendiculars, 26ft. broad and draws 8ft. of water at the normal displacement of 850 tons. Her machinery consists of turbines, apparently without gearing, and three oil-fired boilers. On trial, the Ashi developed considerably more than the 21,000 shaft horse-power stipulated in the contract, and bettered her designed speed of 31.5 knots by nearly 2 knots. She carries three 4.7in. guns, two anti-aircraft machine guns, and four 21in. torpedo tubes. It is evidently the intention to discontinue the building of second-class boats in future, as the whole of the destroyers to be laid down under the new programme are of the first-class type.

Submarine No. 23 shown in our illustration is a "medium ocean-going" boat, completed late in 1920. Her displacement in surface trim is 740 tons, increased to 1100 tons when submerged. The Diesel engines for surface propulsion develop 2600 brake horse-power, and the electric motors for submerged running work up to 1200 horse-power. The highest surface speed is not over 16 knots. Sufficient oil is carried for a radius of 6500 sea miles. Two torpedo tubes are fitted in the bows and two in the stern. A short 12-pounder anti-aircraft gun is mounted abaft the conning tower. According to the British Admiralty Return, there are eighteen boats of this class now in service, all identical as to displacement and machinery power, but a comparison of such photographs as are available does not bear out this assumption. In view, however, of the reticence observed by the Japanese naval authorities with respect to their modern submarines it is not yet possible to give the precise data of each type.

Institute of Metals.

No. III.*

THERE was a good attendance when members assembled in the Llewellyn Hall, Swansea, for the final meeting on September 22nd.

A joint discussion took place on the paper by Dr. F. Johnson and Mr. W. Grantley Jones, "New Forms of Apparatus for Determining the Linear Shrinkage and for Bottom Pouring of Cast Metals and Alloys," and the paper by Mr. F. W. Harris, "The Hardness of the Brasses, and Some Experiments on its Measurement by Means of a Strainless Indentation." Summaries of these two papers are given below.

THE LINEAR SHRINKAGE OF CAST METALS.

In this paper the authors describe two new forms of apparatus: (*a*) for determining the total linear shrinkage of cast metals and alloys; (*b*) for producing cast bars by a bottom pouring method, the molten metal flowing from a specially heated crucible into the mould and the rate of flow being controlled by a lever-operated stopper. Both forms of apparatus have been used in investigating the shrinkage and hardness of chill-cast copper-zinc alloys. As regards the shrinkage values of these alloys, they are found to be higher in general than those obtained for sand-cast bars by previous investigators. The curve illustrating the relationship of shrinkage to composition confirms most of the features formerly discovered by Turner and Murray, but no minimum at 60 per cent. copper is found. In making the alloys pure electrolytic metals were used, whilst re-melted castings were excluded from the investigation. Most of the alloys were poured at a temperature interval of approximately 115 deg. Cent. above their liquidi, and the mould was kept at a constant temperature by means of an outer jacket of water maintained at the boiling point. The hardness of the bars was determined, both as cast and after annealing. Uniformity was not exhibited by the bars as cast, but was secured by annealing. The changes of scleroscopic hardness with composition are of a similar character to those revealed by the Brinell test, but less pronounced, whilst over the range 60 to 53 per cent. copper, no increase of hardness is shown, such as that shown by the Brinell test.

HARDNESS OF BRASSES.

The object of this research was to make a careful study of the hardness of the brasses, and the theoretical conceptions surrounding the question of hardness and its relation to constitution were first discussed. For performing the tests it was decided that the Brinell machine would be the most suitable apparatus to use in this instance. Before the main research was begun preliminary investigations were carried out in order to become fully cognisant with, and to measure the effect of, the various factors influencing the hardness. These experiments suggested the possibility of obtaining a value for the fundamental hardness of a material before strain set in. The theories generally advanced with regard to the connection between hardness and internal constitution have been in the main substantiated. There are

* No. II. appeared September 29th.

certain anomalies, however, which can only be explained by adopting a modified idea of the existing constitutional diagram. The author's curves show a general agreement in type with those of other workers, and confirm the maximum in the alpha phase shown by Meneghini and Turner and Murray, although throughout the series they are considerably lower in hardness value than those of the latter.

Dr. Johnson said that Mr. Harris had acted wisely in concentrating his attention on one point among so many elusive factors. His curves appeared to show that there was a maximum point of hardness between 70 and 100 per cent. of copper. So far as the work of Mr. Jones and himself had gone, they did not for a moment dispute the possibility of a maximum at that point, but they could not say they had found it. Further work might prove its existence, but under the most favourable conditions for producing a series of copper-zinc alloys in the casting shop a maximum point in the hardness curves was not to be expected. With regard to the structure of the brasses as annealed, neither Mr. Harris nor Mr. Jones and himself had yet obtained conditions which would justify the dogmatic assertion of the existence of any particular maximum in that series. With regard to the distance to which the influence of the Brinell impression extended, Mr. Harris had endeavoured to obtain a rough idea of that distance by microscopical examination of a section taken through a Brinell impression. He did not think such examination was sufficient, and was of opinion that the scleroscope would be more likely to throw light on that subject.

Mr. A. H. Munday expressed alarm at what had been said on the question of the newer methods for the determination of hardness. Looking at the subject entirely from the manufacturers' and users' point of view, it appeared to him they were having their faith broken in the Brinell test. It would be necessary to put something in its place. There was an aspect of the question which had probably not occurred to the majority of the members present. When he was at Woolwich during the war period, much trouble occurred in regard to what was christened "cutability"—the power of cutting metals rapidly. Dissatisfaction was caused because certain of the alloys became too hard to cut at the speeds which were required for the output of the various components which were necessary. At the time manufacturers were passing through a period of great stress, and the shop steward movement was at its height. Deputations of shop stewards waited upon the management and threatened to strike or to hold up the work because a metal was a little bit harder than that for which a standard rate of pay had been fixed. It was decided that all such cases should be referred to him for decision. He was able to convince the men that they could rely on the Brinell test. He emphasised that point because the new standards which were being introduced would shake the faith of the engineer in tests which had been carried out on old lines. That was to be regretted, as the hardness figure was only beginning to establish itself in the minds of the designer and user, who too often preferred to rely on tensile tests with elongation and reduction of area. He pleaded with metallurgists not to put forward a new test until they were quite certain it gave more accurate results than the old method.

Professor T. Turner said Dr. Johnson and Mr. Jones's paper dealt with a new form of apparatus for determining "linear shrinkage," and he desired to congratulate the authors on the use of that term. He was very interested to see how, with a somewhat different method of working, and with an entirely different apparatus, the results which the authors had obtained showed so close a correspondence with the work done by Murray. Observations of the same character had now been made by Keep, by Wüst, by Messerschmidt, and by Johnson and Jones, and since they all obtained similar results, it was obvious that they were dealing with the real characteristic properties of the alloys under review. Mr. Munday had referred to the question of the Brinell hardness test, and had commented on the fact that manufacturers and users were likely to have their faith shaken in it. After all, the Brinell hardness test, useful as it was from an engineering point of view, was a very imperfect method of determining hardness from a scientific standpoint. There was in many cases considerable deformation and surface hardening. Mr. Harris had endeavoured to remove that and get down to the ultimate, or, as he called it, the absolute, hardness. He suggested that what Mr. Harris was doing was really to give the elastic limit of the material. It was well known that it was very much easier to determine the tensile strength of a material than it was to determine its true elastic limit, especially if it was a ductile material. It might have no appreciable point at which the elastic limit could be recognised. That was an important matter from the point of view of the wear of the material. For its cutting properties, the ordinary Brinell test might be more suitable, but if abrasion or the effect of small stresses which just affected the surface and would cut into it and cause it to wear away were considered, obviously one was not so much concerned with the Brinell hardness.

Dr. Rosenhain, referring to the method of strenuous testing described by Mr. Harris, doubted if it reached the ideal of determining what might be called the elastic limit of surface deformation which one would like to determine for hardness testing. The Brinell test was useful in a certain rough-and-ready way. It gave a certain easy correlation between the tensile strength and the Brinell number, but that test was undoubtedly being over-ridden at the present time. People were attempting to do far more with it than it deserved, and if the faith of the engineer was shaken in it, it was a good thing.

Professor C. A. Edwards said the interest in the curve Mr. Harris used arose from the fact that it would give far more data concerning the Brinell hardness test than had hitherto been available, and that was to his mind an extremely important point. It gave a means of, at any rate, approximately obtaining the intrinsic hardness of a material. The hardness number was available, and by subtracting the one from the other the capacity for work hardness was obtained. That, he believed, was going to be, when properly handled, a very important factor, because he thought it might be possible, although not at the present time, perhaps, to correlate that difference of hardness with what a previous speaker referred to as the "cutability" or "machinability;" and he thought that would prove very shortly to be quite an interesting method of looking upon those facts. With regard to the comparison which had been made of the constitution with the hardness, and more particularly with regard to the maximum which appeared in the alpha range, the difficulty which had been experienced arose from the fact that Mr. Harris and other workers had compared the alpha range, which could be regarded as more or less stable, with another range which was not perhaps stable. It would be better if the beta phase was compared at a higher temperature. He was much interested in Mr. Harris's attempt to throw more light on the constitution of solid solutions. If Dr. Rosenhain knew as much as he had suggested on the previous day on that subject it would be an advantage to have that information. More actual facts were required.

Mr. W. Grantley Jones said he and Dr. Johnson had looked for more comments on the apparatus employed, as they hoped that at some future date that sort of apparatus might be adopted for commercial purposes. As shown in the paper, it had many advantages. He hoped that the loss of faith of engineers in the Brinell hardness would inspire some of them to design a test other than that which had been suggested by himself.

Mr. Harris, in reply, said it was beginning to be realised that the Brinell hardness figure was not so satisfactory as could be wished when considered from a theoretical standpoint. He thought that any effort which might be made to investigate it more deeply was justified.

The next paper taken was that by Mr. F. L. Brady, "The Structure of Eutectics," of which we give a brief abstract.

THE STRUCTURE OF EUTECTICS.

This paper deals with the structures exhibited by eutectics, mainly those between metals and metallic compounds. An attempt is made to correlate the microstructure of a solidified eutectic with the physical properties of the component metals. The surface tension of the molten metal and the cohesive force acting during crystallisation seem to be the main forces influencing the final structure. The eutectics examined, which included those between metals whose physical forces are known, fall quite decidedly into three classes. The terms "globular," "lamellar," and "angular" have been suggested as convenient terms for these divisions. The structures agree well with what would be expected from theoretical considerations of the effects of surface tension and cohesion. Reference is made to structures in eutectic igneous rocks, and an examination was made of earlier work on the effect of rate of cooling on the size of the individual phase particles in a eutectic.

Mr. A. H. Munday said he wished to ask two questions from the point of view of the manufacturer and user. Those who made printing metals were confronted with certain difficulties. One alloy which was used for the Linotype machine stood molten for many hours. That alloy was very nearly of eutectic composition, and he was under the impression that cuboid crystals of tin-antimony were deposited. He would like to know if it was possible with a eutectic of the ternary alloy—lead-antimony-tin—for a further deposition of the crystals to occur? He thought it did occur to some extent, and it was a point of practical difficulty. His second question related to the antimony-lead cast alloy which was used for the manufacture of acid-resisting materials. It was very suitable for valves and containers, and it had been found, as the result of experience, that if a fine grain was obtained in this material by rapid cooling it was much less liable to attack from pitting than if allowed to cool slowly. He would like the author to tell them, if he could, what was the influence of the eutectic on that particular property of the alloy. Chemical manufacturers would be much interested in his reply.

Dr. O. F. Hudson referred to the part played by surface tension in eutectics. He agreed with the author's classification of eutectics into two classes, the globular and lamellar, but believed that the latter and not the former was the fundamental type. He had investigated the effect of small amounts of impurities in the eutectic of copper and copper sulphide. The impurities had the general effect of causing the eutectic to break up and to assume a coarser form.

Mr. Brady was unable to answer Mr. Munday's questions, but suggested that light might be thrown on the difficulty with printing alloys by an examination of the ternary diagram of the system. With regard to the antimony-lead eutectic, the fact that less pitting took place with a fairly rapidly cooled material was probably due to the fineness of grain. It was impossible, however, to be dogmatic on that point.

In the absence of the author, a paper by Mr. Maurice Cook on "The Antimony-bismuth System" was taken as read. It is summarised as follows:—

THE ANTIMONY-BISMUTH SYSTEM.

Several workers have investigated the equilibrium diagram of these two metals, and though the opinion that the system is isomorphous is generally held, the diagram has never been completed. Early investigators gave only the liquidus curve and Hüttner and Tammann, in 1905, gave, in addition to a new liquidus curve, part of the solidus, which they found to be horizontal at 266 deg. ± 4 deg. Cent. and extending from 0 to 70 per cent. of antimony. In the present work very thorough thermal and microscopic investigations were made. The results obtained, in addition to those from quenching and annealing experiments, show that the two metals form an isomorphous series of alloys. The liquidus curve is perfectly smooth and the solidus is horizontal at 270 deg. Cent. up to 60 per cent. of antimony, after which it rises steeply to the freezing point of antimony. Chill cast and slowly cooled specimens reveal duplex structures, but with prolonged annealing—550 hours at 275 deg. Cent.—the alloys become homogeneous. Twin crystals and peculiar banded effects were observed in some of the annealed specimens. It is supposed that the twin crystals were formed during the solidification of the alloy by stresses due to expansion, and grow to visible dimensions on annealing. The nature of the "bands" has not been definitely ascertained, but they are not considered to be slipbands.

Miss Gayler raised the question of the rate of cooling, which all those who had studied the subject knew to be a very important point. The author had failed to get a homogeneous structure, probably because his rate of slow cooling was not slow enough.

Dr. J. L. Haughton desired to know how the author controlled the furnace temperature at which specimens were annealed. It was not an easy matter to keep the furnace temperature steady over so long a period.

Dr. W. R. Evans said that the author would be glad to have the opinion of other workers on the peculiarly banded structures in what were evidently homogeneous annealed alloys. The occurrence of a twin structure or what looked like a twin structure in an alloy which had been subjected to no external mechanical straining was also worthy of attention. The author had to overcome great difficulties in dealing with the alloys, particularly in the preparation of the micro-sections.

Professor Edwards was particularly interested in the fact that it had been necessary to anneal some of the alloys in order to get a stable structure at a temperature which was very frequently the temperature of transformation. As to the cause of the twinned structures; in addition to the possibility of stresses being set up through solidification as a result of the increase of volume, there was also the possibility that stresses were set up by the diffusion associated with the establishment of equilibrium. That might easily give rise to twin crystals.

Mr. A. Jefferson then presented in abstract his paper dealing with "The Cause of Red Stains on Silver-plated Work." We summarise this paper very briefly below:—

RED STAINS ON SILVER-PLATE.

The red stains sometimes observed on finished articles which have been electro-silver plated cause considerable annoyance, and their origin has been somewhat of a mystery to those engaged in the trade. The occurrence of the trouble in individual works is often intermittent, and by some has been considered seasonal and to be particularly prevalent in hot weather. The Sheffield Silver Trade Technical Society appointed a committee to discuss the matter and subject it to experimental study. It was found and definitely established that the red stain was caused by the indiscriminate use of rouge in the finishing and polishing processes, through the absorption of the rouge into the open pores of the heated surface, the heat being evolved by the friction of the hand or finishing "dolly."

Dr. R. S. Hutton welcomed the paper as a somewhat unique contribution to the "Transactions" of the Institute. It was the spontaneous production of a committee of workers engaged in the silver industry who had attacked a very troublesome works problem, which was often the cause of inter-departmental bickering. They had investigated the subject in a practical way and not on scientific lines, and it would prove very helpful if metallurgists would come to their aid with a scientific explanation of the phenomena.

Professor T. Turner thought that the Committee had reached a correct conclusion as to the particular works trouble involved. In silver plating, staining did not occur as the result of copper as in nickel-silver and other cupro-nickel brass and other alloys. In the case under discussion the staining was caused by rubbing the rouge into the soft material, and if the real cause was realised the trouble could be overcome by a slight modification of works methods.

A vote of thanks was accorded to the Committee of the Sheffield Silver Trade Technical Society for the paper.

A paper on "Intermetallic Actions: The System Thallium-arsenic," by Mr. G. A. Mansuri, was taken as read. A brief summary follows:—

INTERMETALLIC ACTIONS.

By means of thermal analysis and microscopic analysis the author has shown that thallium and arsenic do not act chemically with each other, nor do they form solid solutions. They alloy in all proportions and the equilibrium diagram of the system is a perfect case of the immiscibility type. First, arsenic dissolves in molten thallium and lowers its freezing point until a solution of 8.01 per cent. arsenic freezes at the eutectic temperature of 215 deg. Cent. Then the freezing points of the alloys gradually rise to 240 deg. Cent. All alloys containing from 13 to about 40 per cent. arsenic begin to freeze at 240 deg. Cent. and are made up of two layers, the upper layer rich in arsenic while the lower is rich in thallium. After about 40 per cent. arsenic, to nearly pure arsenic, the solution is uniform and the two layers disappear.

Miss Gayler disagreed with the conclusion of the

author that his work clearly established the fact that thallium and arsenic did not form solid solutions. The only evidence he gave in support of that statement was the result of experiments with an alloy containing 79.48 per cent. of arsenic. To get the extreme limits of solubility more alloys should have been tested. The author's diagram was incomplete and to some extent without meaning.

One other paper was taken as read without discussion. We give a short abstract of it :—

THE CLEANING OF ALUMINIUM UTENSILS.

By P. Seligman and P. Williams.

For nearly half a century the difficulty of cleansing aluminium has hindered its entry into household and factory. This difficulty is due to the fact that the metal is freely dissolved by hot soda solution, the most common detergent. The difficulty disappears entirely if the simple device be adopted of adding very small quantities of sodium silicate to the soda. Some years ago the surprising observation was made that aluminium was immune to attack by water-glass solutions, which at once suggested that the well-known detergent properties of such solutions might be enlisted for cleaning the metal. That was done with complete success. Water-glass is, however, an inconvenient material to put into the hands of the general public, and the problem could not therefore be regarded as completely solved. Later it was found that even small quantities of sodium silicate in soda solutions produce the same effect as a solution of water-glass. For example, the attack by a 5 per cent. soda solution is immediately arrested by the addition of an amount of sodium silicate equal to 1/100 of the soda in the solution. By this observation the problem may be considered solved, because detergents consisting of a mixture of soda and sodium silicate are articles of commerce and readily procurable in most parts of the world. Among those which have been used with complete success are compounds sold for domestic purposes under the following trade names :—"Carbosil," "Pearl Dust," and "Aquamol." Boiling solutions made up with London tap water and containing 0.5 per cent. and over of these materials remove grease readily without affecting the aluminium in any way.

It was announced that it had been decided to form a local section of the Institute in Swansea.

The conference terminated with votes of thanks to all those who had contributed to the success of one of the most useful provincial meetings of the Institute.

The International Railway Congress

No. III.*

Passenger Carriages.

The report of Mr. R. W. Reid—the reporter for Great Britain, India, Australia and South Africa—was summarised in The Engineer of April 14th. The President of the Section, Mr. George Gibbs, opened the discussion by observing that in America steel cars had been used for several reasons, of which the most important was their resistance to fire. Mr. Reid said that in England the introduction of the steel vehicle would increase the weight to be hauled per passenger. It was considered better to look for safety by improvements in the signalling than by building carriages better able to resist damage in the case of of derailment and collision. Mr. W. J. Tollerton—reporter for America—remarked that in America journeys were often of great length, and the provision of greater comfort was looked upon as of more importance than the trouble arising from an increase of the weight. The repair of steel-built vehicles was much easier than of those built of wood—rarely more than re-painting was required. The President observed that steel vehicles were not necessarily much heavier than wood, perhaps 10 per cent. Mr. Reid said that in suburban services the weight of the vehicles having a steel underframe and a wooden body amounted to 600 lb. per seat, while with all steel it reached 900 lb., and if it were required to give a greater strength with a view to collisions, on the lines of the United States practice, the weight per passenger would be 1400 lb. Mr. Arthur R. Cooper said that on the Metropolitan-District all-metal vehicles were found not wholly a success. As far as noise, cold, and appearance were concerned they were less satisfactory than the other type.

Mr. Van Loenen Martinet (Holland State Railways) informed the Section that the electric lighting of trains in Holland began in 1910 with a dynamo per vehicle. The cost was little less than double that of gas, but improvements since then had decreased the cost. Mr. G. T. Glover (Great Northern of Ireland) said that all the vehicles on that line were lighted by electricity for reasons of comfort. Only eighteen men were required to attend to the electric lighting of 600 coaches. The batteries had a life of nine years, and had only to be renewed after running 90,000 miles. Colonel Pringle (representative of the British Government) remarked that he was in favour of electric lighting, which he thought was safer. The British railways had begun to change over from gas to electric lighting. Mr. G. T. Glover said that as the results of tests he had found that it was not possible to heat a coach by means of a dynamo driven from an axle.

The subject of brakes should then have been discussed, but Mr. Reid proposed that, as this subject was so wide, it should be passed over. The President approved, and the Section agreed.

Twin carriages, as on the Great Northern Railway, formed the next matter for consideration. M. Duchatel (Eastern of France) criticised the arrangement, especially the inconvenience which would arise in derailment. Mr. Gresley stated that the system arose also from a desire to utilise old carriage bodies, but the method had been applied to the construction of new coaches. The composition of the trains remained the same, and hot boxes were extremely rare. The underframes were strengthened by the use of four tie rods instead of two, but the additional weight was more than compensated for by the saving in buffers and couplings. He thought the articulated train gave greater safety than the ordinary train.

Among the conclusions of the Section were :—

The use of all-metal or nearly all-metal carriages has developed rapidly in North America. This method of construction is now generally adopted there, and is considered to reduce to a minimum the risks attendant on derailments, collisions and fire.

In Europe metal construction has not been applied to any appreciable extent, except in the case of electrified lines. On certain lines, however, steel construction is being considered with a view of reducing fire risk ; it is not intended to approach the weights of the American coaches, which have been partly incurred owing to additional comfort provided for passengers.

Notwithstanding the safety devices introduced, gas is now, in some countries, considered to be dangerous and to be liable, if not to cause, at least to increase, fire following on collision. Electricity, particularly for this reason, tends to replace gas completely.

Electric Traction.

Three of the seven reports on electric traction were reviewed in The Engineer of April 21st. Mr. J. Sayers (Midland) called attention to the inductive effects of the traction lines on telegraphs and telephones. On British railways these effects have probably been the determining factor in the selection of the direct-current system by the Government's Electricity Advisory Committee, other advantages and disadvantages in systems being about equal. M. Huber (Swiss Federal Railways) said it would be a good thing if the telegraph and telephone authorities could move their wires from the neighbourhood of the traction lines ; in some cases, however, that could not be done. In Switzerland, therefore, the possibility of moving the wires had not been the determining factor in the selection of the system to be employed.

Sir Philip Dawson, on the subject of overhead conductors, gave some very interesting information about the wear of the contact wires on the London, Brighton and South Coast Railway. It was negligible at points where there was no consumption of current and where there were no steam locomotives running. Abnormal wear had been avoided by the prevention of hard points and, generally speaking, he could say the wear was more than proportional to the current collected. Mr. A. Donati (Italian State Railways)—reporter for Italy—said that, after the long experience which had been obtained on the Valtelina line, he could say that there was entire satisfaction with the installation of transverse suspension. On a three-phase line in the vicinity of Turin the delays due to the contact wire were but 80 minutes a month out of 2080 minutes' total delay. Mr. Sayers stated that the Midland Company had experimented for fifteen years largely with the object of obtaining an overhead contact wire free from hard points, and the result of that experience was entirely in favour of catenary suspension ; in fact, to avoid vertical inertia, necessarily associated with pull offs, he had devised a system which dispensed entirely with separate pull offs, in which every dropper was a pull off. That system had been used with great success. He suggested that the question as to whether transverse or catenary suspension was the more desirable depended on the speed of the traffic and the quantity of current to be collected. The President supported Mr. Sayers' view, and was of opinion that no other system than the catenary could be satisfactory for a railway with a heavy traffic and fast trains. Mr. Donati pointed out that on the three-phase Italian lines simple transverse suspension gave excellent results, even for speeds up to 62 miles per hour.

M. Sabouret (Paris-Orleans)—one of the reporters—wished to know why single-phase current had been abandoned on the Norfolk and Western in favour of the split-phase system. The President explained the chief reasons. In the first place, the length of the trains cause very great difficulties in starting the locomotives simultaneously, with the result that a heavy current passed through the motors whilst standing. The importance of the gradients and the necessity of recuperation had to be considered. The general conditions of the line, especially of one tunnel in the section, made it impossible to put up two overhead conductors for direct collection to the three-phase motors ; hence the necessity for collecting from a single-phase contact wire and converting to three-phase through the phase splitter. M. Huber stated definitely that in Switzerland the single-phase system on some lines, not less difficult than those on the Norfolk and Western, caused no trouble. The locomotives were employed in multi-traction as simply as steam locomotives.

The President mentioned that, as far as shunting in the terminal stations was concerned, the use of trailer cars in America was entirely abandoned. Mr. J. V. B. Duer (Pennsylvania System) explained that on that system only motor cars were used, that the terminals had not been provided with a sufficient number of sidings for the shunting of trains and of groups of vehicles, and that the cost of fitting up all the cars was not as high as might be thought. The solution adopted by the Pennsylvania avoided all the difficulties or failures which result from the overloads of a motor car called upon to haul too great a number of trailers ; overloads which were bound to be permitted, or ordered by the traffic department, in emergencies. M. Parodi (Paris-Orleans) stated that on the French State Railway all cars were, at first, fitted as motors. After a certain time it was recognised that the use of trailers caused no difficulty. Mr. Donati said the same as to the Milan-Varese line.

The conclusions of the Section were :—

The Congress recognises that at present a single system cannot be recommended for all cases, any more than in the past, nor is it possible to choose between several systems, all of which have proved their value under the most severe conditions of operation ; the Congress recognises, moreover, that these systems are all susceptible of considerable further improvements.

The Congress agrees on the uselessness of standardisation of the type or pressure of current in the contact wire on account of the ease with which locomotives may be changed at the frontiers of the different countries.

It is desirable that the methods of keeping and supplying technical and economical information on electric traction should be defined and standardised, and, with this object in view, the Section suggests that this point be referred to a special committee of the Association. This committee should draw up very fully the details governing each point, so that in future as full a comparison as possible may be made by means of figures absolutely comparable.

Liquid Fuel.

The note on this subject by Sir Henry Fowler was reproduced in The Engineer of April 21st. The resolution of the Section thereon was as follows :—

There are no mechanical difficulties in the adoption and use of liquid fuel for locomotives. The question of cost, both of the fuel and maintenance, makes its use, however, prohibitive at present, except in certain localities, and these are so restricted that the subject is not recommended for discussion immediately. If prices should vary it might, however, be desirable that it should receive consideration later.

The question of the use of liquid fuel in conjunction with internal combustion engines on locomotives is, however, one of more general interest, and might be considered later.

Locomotive Cab Signals.

M. F. Maison (French Ministry of Public Works) gave an account of the development of cab signals in France, and expressed the opinion that the number of accidents which had occurred led the public to recognise the necessity of repeating the signals in the cab of the locomotive. He was of opinion that the repetition of signals in the "off" position, if adopted, should be arranged so as to be quite distinct from the repetition of "danger" signals, and in such a way as not to disturb the attention of the driver. He also thought that an automatic train stop was difficult to arrange because of the different speeds of various trains running on the same line. Systems, including the automatic stop, were being accepted in France for investigation and experiment, which were rejected, without being examined, twenty years ago. The visual signal in the cab did not appear to him to be desirable because the driver should watch the signals along the line and not those in his cab. The equipment of the lines and engines in France would be completed by July 1st, 1924.

Colonel Pringle referred to the work of the Automatic Train Control Committee. More than one-third of the serious accidents occurring in Great Britain in a space of ten years would have been avoided by the repetition of the distant signals and more than one-sixth by the repetition of stop signals. M. Duchatel (Eastern of France) shared in the astonishment and disagreement of French locomotive engineers with some of the opinions expressed in M. Maison's report. He could not let pass, without a protest, a report from which it might be concluded that the observation of signals on the part of drivers was difficult or their disregard of signals excusable. In view of the acceleration of trains and the increase in the length of the boiler barrel, the French railways had not neglected this subject. They were giving great attention to improving the visibility of signals from the footplate. For the same reason they were again arranging for engines to be driven from the left-hand side. The fixing of the positions of the fixed signals had been revised and, where necessary, auxiliary signals were provided. The speaker considered that it was not proved that the repetition of signals upon locomotives would lead to an increase in safety. Was it really thought that a driver would pay as much attention to the fixed signals if they were repeated in the cab ? One must compare the present failures of a driver, relying solely on his eyesight, with the future failures of driver and apparatus when the man was dependent upon the latter. In which was the greater safety ? M. Maison contested the view taken by M. Duchatel, and emphasised the increase in the

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average running speed of trains during the last twenty years and the much greater amount of attention required in driving modern locomotives.

M. Sabouret (Paris-Orleans) thought that it would not be satisfactory were the Congress to express opinions on a system which had not been proved in actual practice. With that view the Section apparently concurred, because it resolved that—

> It appears that it is impossible to arrive at definite conclusions because the matter is still in the experimental stage.

Institute of Marine Engineers.*

The changes that have taken place during the period of my service may properly be described as wonderful. Those changes have appeared in every direction, and most of them, it is pleasing to say, have been highly beneficial and useful. To mention a few of the many instances, the conditions of living, public health, education, recreation, means and speed of locomotion and methods of intercourse have all undergone vast changes, and those changes, some slow, some rapid, but all insistent, have had an effect on the character and life of the nation, greater, probably, than that of the changes of any previous period of the same duration. The changes that have been made so far in the endeavour to combine, measure for measure, handicraft or machine work with a knowledge of engineering principles have already been attended with beneficial results, alike to the apprentice and the master, and they have provided opportunities for lads gifted above their fellows, to rise to positions of authority and trust which otherwise would have been closed to them.

I am not sure, however, that the best has yet been attained in this direction or that the best means have yet been adopted, and I feel that some of the best work of the future lies in further improvements in our methods of training, and in suiting the quality and degree of the training to the capacity and the intended future of the individual. Youths should always be encouraged to connect the methods employed with the purpose at the beginning and the result at the end, and I am inclined to think that such encouragement not only rapidly develops the boys themselves, but proves ultimately to be of considerable all-round benefit.

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Probably greater progress has been made in marine engineering during the last forty years than in any other application of technical science, except perhaps electrical engineering—a new industry in that period, and one, therefore, in which rapid progress could be anticipated—and even in that fascinating and highly progressive branch, marine engineering has had an important influence in the prior or concurrent development of prime movers of high power and speed. The progress in marine engineering throughout has been such as to make me feel that I have been fortunate in that my life has been placed in that period. In my early days in the Navy perhaps the slowest steamships on the face of the waters were men-of-war, and I have taken part in some unauthorised but nevertheless real attempts to race merchantmen, and those not of aristocratic class, in which we were hopelessly beaten. It is probable that, on account of the considerable diminution in naval shipbuilding, the merchant service will in future take a more prominent part in general developments than in the immediate past, although it may not do so in those features which are essentially naval in their character.

The principal changes that have taken place in naval machinery in the period I have referred to are :—

(1) The general change from horizontal to vertical engines, the latter being of short stroke in order to keep the machinery under protection.

(2) The increase in boiler pressure and the change from compound engines to the triple-expansion type.

(3) The application of forced draught, in the first place to tank boilers.

(4) The use of locomotive boilers for a comparatively short period.

(5) The introduction of water-tube boilers and the evolution of the most suitable types.

(6) The use of higher speeds of revolution of reciprocating engines, together with many other devices for reducing weight.

(7) The more recent general introduction of steam turbines and of mechanical reduction gearing.

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Progress with the heavy oil engine in Great Britain was for many years extremely slow, due presumably to the fact that, unlike other countries in which development had been more rapid, we had cheap and abundant supplies of coal, and also had had an immense and satisfactory experience with, and had reached a high stage of perfection in, the reciprocating steam engine ; in fact, our commerce had been built up with this engine. The successful introduction of the turbine gave, in certain quarters, a set-back to reciprocating engines of all types, and this feeling also took a share in the relative retardation of the Diesel engine in Great Britain. For submarine work the oil engine was, and largely is, a necessity, and it was in these vessels that the marine oil engine was first used in this country, the earlier ones being petrol engines and all recent ones of the Diesel type. The Admiralty gave a further lead by fitting some of its auxiliary vessels of lower power with slower running oil engines of more commercial type, and I am inclined to think that the ordering of some of these engines from the Continent put British engineers on their mettle in characteristic and commendable manner and was the prominent factor in the real start of the industry in this country.

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Now, I think I have been reminiscent long enough. Reminiscences are only useful if we can deduce from them something that can be put to good purpose ; otherwise they are recreative or irritating only, and they only affect the individual indulging in them.

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I think there is nothing to equal the enthusiasm of engineers for engineering. It is this liking and affection, combined with certain natural advantages that has placed British engineering in the forefront hitherto, and if the same spirit imbues our younger brethren it will keep us there for many years yet. The country possesses these young engineers in large numbers ; they are well trained, eager and full of enthusiasm. Taking a long view, the future of British engineering lies with these young men, and with the knowledge that I have of their ability and energy, I have no fear for the future, provided facilities are provided by institutes such as this and in other ways to enable them to follow their inclination. If this confidence is widely shared it should be very comforting, as the problems of the future will apparently be at least as difficult and exacting as those of the past, and probably more so.

It will be interesting briefly to consider the nature of some of the problems that will have to be faced in the near future by the marine engineer, and the qualities required of him in dealing with them.

(1) The reciprocating steam engine has reached such a stage of perfection that no radical improvement in its performance is expected, and those to whom it is an acceptable type will take it in its present satisfactory form with the greatest confidence.

The steam turbine as a propelling engine is rapidly growing in favour and presents some interesting problems in the practical improvement of its details and in the endeavours to obtain a high thermal efficiency.

(2) In order to combine a high turbine efficiency with a high propeller efficiency reduction gearing has recently been introduced. In this country the gearing has almost entirely been of the mechanical type, and in several cases it has brought with it its own troubles, troubles involving problems of a highly interesting character. They take the form of breaking and occasional wearing of the teeth. Experiences have varied. In the Navy mechanical gearing has behaved satisfactorily. The failures have occurred chiefly in the merchant service. A comparison has naturally been instituted into the differences between the conditions of service, methods of manufacture and inspection, and other attendant circumstances in the two services. Time is too short to examine these differences to-night ; they have already been, and will be, more fully discussed on more suitable occasions ; but the point I wish to bring out is that the discussions that have taken place show that the marine engineer, in order to take the important part that belongs to him, must have a clear notion, perhaps much clearer than it now is generally, of the nature of the transmission of power by helical toothed gearing, of the action between the teeth, and of the movements of the teeth in contact relatively to one another. In these discussions another situation has arisen, not, however, for the first time. It has been supposed by some that in the cases of failure the material has been at fault, and the general impression I have formed is that the suspecting engineer, however warranted his suspicions may have been, has not been able to carry the charge far enough. I have urged for a long time that the practising engineer of the future must possess a better knowledge of physical metallurgy than he generally possesses at present, and by this I mean a general knowledge not only of the mechanical properties of the metals he uses, but also of their structure, and the changes to which they are liable in use, or which can be produced in them by working and by heat treatment. This subject, in its elementary form, must form part of the training of our young engineers, and this matter so much concerns marine engineers that I consider this address a suitable place to repeat the advice.

Other methods of effecting the reduction between the high-speed turbine and the slow-running propeller are also being used, chiefly abroad. In America, and to a small extent in this country, electrical gearing has been favoured. It has some advantages over mechanical gearing, but it has also some disadvantages, especially at what may be termed the design stages. As far as I have been associated with such proposals they appear to be expensive in first cost and to require greater weight and space than in some cases can be allowed. Considerable economy in fuel has been claimed for this form of transmission, especially at low speed, and although there is no reason to doubt the accuracy of figures that have been published, care should be taken in making a comparison to ensure that the conditions and attendant circumstances are similar.

In Germany hydraulic gearing has been applied to some ships. One of them has been recently added to the Canadian Pacific Company's service on the Pacific side. Her performance will be of considerable interest, especially in the matter of fuel consumption, as the efficiency of hydraulic transmission is understood to be somewhat low, notwithstanding the heat-saving devices that can be utilised therewith.

(3) Steam boilers, both of the tank type and the water-tube type, have been highly developed in this country, and the efforts which have been made to obtain the benefit of superheated steam in marine installations, especially in the merchant service, have been most creditable alike to the designers and to the engineers in charge. The problem is affected in the Navy by the fact that although a large measure of benefit can be obtained at full power, it has been difficult to realise any material advantage when the boilers are being worked easily at low power. It is hoped that recent successful experimental work can be applied in this direction with better prospects.

(4) In America very high boiler efficiencies have been claimed, under certain conditions and with special fittings, which, if maintained on service afloat, will put our engineers on their mettle, and in order to ensure that we shall maintain pride of place it will be necessary for the marine engineer, to whom this problem principally belongs, to have a very wide knowledge, not only of the methods of efficiently burning oil fuels, but of the nature of the fuels themselves, and of the conditions affecting their efficient and economical combustion.

(5) Oil engines for propelling and auxiliary purposes will compel profound consideration for many a long day, and in the near future discussions may take in large part a different form.

(6) The light oil engine has been fitted for propelling purposes in a large number of small craft, and although this application is not largely connected with sea-going engineering, it is interesting to observe that the Royal National Lifeboat Institution has decided, as far as financial considerations will allow, to proceed with a scheme for establishing motor lifeboats round our coasts, an action which is significant of the reliability that can now be placed on machinery of this type, and one which cannot fail to be of interest to all sea-faring people and which is deserving of their support.

(7) The methods of lubrication of rubbing surfaces have received considerable attention during the last few years, and the correct principles of lubrication are now better understood than they formerly were.

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I have taken more time than is really necessary in a brief reference to the few examples I have quoted, but I wished to show that a great deal will be required of marine engineers to enable them to deal efficiently with the problems confronting them, and that it will be necessary for them, individually or collectively, to keep themselves abreast of the advance of the technical sciences bearing upon their work and interests, in order that their experiences may be effectively incorporated in the applications. To this there is no end ; the same will be required of the engineer of the future as is demanded to-day, probably more. Demands are as incessant as they are varying and exacting, and the young engineer will have to bear his part in the same spirit as his elders. Progress will not permit of rest ; the problem of to-day will become the practice of to-morrow ; but that practice, however successful, is bound to be assailed. Competition follows, bringing its own difficulties, its problems and its triumphs, and so on, in never-ending succession. But competition is an important and inspiring factor in progress, its stimuating effects being far-reaching and often apparently felt on both sides. The battle that proceeded for some years between the several types of water-tube boilers is a striking example ; as one type exhibited or claimed superiority in any particular respect, responses to overhaul this lead were made on behalf of the others, a process which was repeated so frequently that many of the boilers were improved in a very substantial manner and very much to the advantage of the user.

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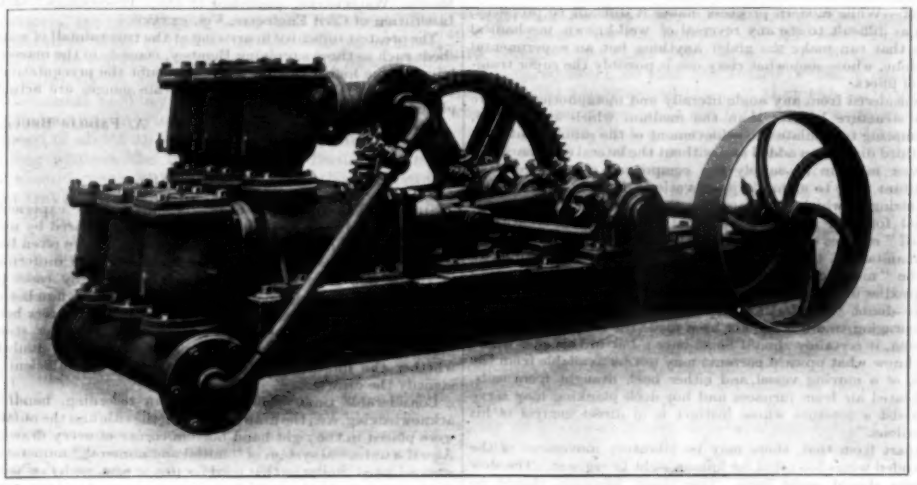
Enough has now been said to show that engineers will always have their hands full to maintain the march of progress, and the questions arise whether we are sufficiently equipped to deal with the problems that are, and will be, presented to us, and whether our methods are the most efficient for the purpose. In the main I think satisfactory answer can be given to these questions, but a short consideration of some factors may not be out of place.

Many of the problems before engineers, and among them marine engineers, cannot readily be solved without the help of other individuals and associations, and co-operation among those interested should be encouraged by those in authority. It is very pleasing to notice that co-operation of this character is more customary now than formerly, and it has been productive of a great deal of good.

* Excerpts from the presidential address delivered by Sir George Goodwin on September 12th.

Electrically Driven Treble-Ram Pump.

There has been recently a considerable amount of discussion among mining engineers as to the relative merits of electrically driven reciprocating ram pumps as compared with electrically driven turbine centrifugal pumps, and although the latter have admitted advantages, chiefly in their first cost and the smaller space occupied, many engineers and mining men still hold the opinion that the treble-ram pump is more efficient in power consumption, and is more reliable in operation than the turbine centrifugal type, especially in cases in which a moderate amount of water has to be raised to a considerable height.



HORIZONTAL TREBLE-RAM HIGH-HEAD PUMP

We illustrate above a treble-ram pump, constructed by Joseph Evans and Sons (Wolverhampton), Limited, which was installed recently at a colliery in Scotland, where the work of pumping had formerly been done by turbine centrifugal pumps. The pump has three 9in. diameter rams, 12in. stroke, is fitted with single reduction, double helical, machine moulded gearing, and on the countershaft there is a belt pulley, 5ft. 9in. in diameter. Power is transmitted from a 24in. diameter pulley on a Metropolitan-Vickers direct-current motor by means of a balata belt. The bed-plate of the pump is formed of four cast iron longitudinal girders, braced together at the end furthest from the pump barrels by a cross girder, whilst the pump barrels themselves are provided with bracketed feet, which span the girders, and are secured by fitted bolts, thus thoroughly bracing the bed-plate girders together at that end. The slides on which the crossheads work also span the girders in the same manner, and thus form additional bracings. The slide plates, being separate from the bed, can be adjusted vertically to compensate for any wear that may take place.

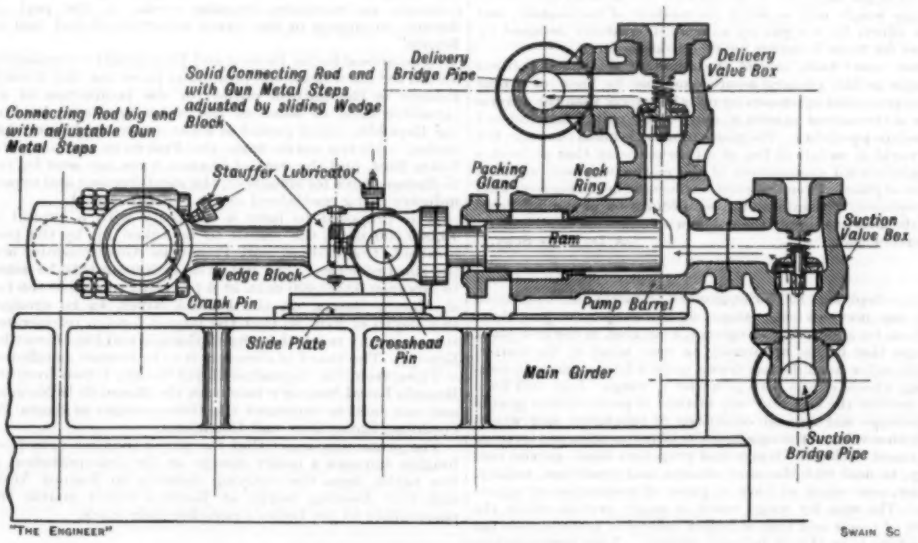
The three working barrels are interchangeable, while all the six valve boxes are also separate and interchangeable with one another, so that in case of mishap or breakage only a comparatively small portion of the pump need be renewed. The crank shaft has four bearings, provided with heavy gun-metal adjustable steps, giving ample wearing surface, and the pedestals, being separate from the bed-plate, are independently adjustable so as to ensure proper alignment and facilitate the compensation for any wear that may take place. The connecting-rods are of cast steel, with adjustable brasses at each end. The crossheads are constructed separate from the rams, and have large slipper area to take the thrust from the connecting-rods.

The valves are of the maker's high-duty type, having gun-metal mitred plates, which are so arranged as to take the main load when the valves close on their seats, but water-tightness on the mitring is not attempted; the slight annular space between the valve plate and the seating is sealed by means of a rubber disc on the back of this valve plate, and superposed thereon is another plate which takes the pressure of the spring. The valve plate works on a renewable stalk, and it will be noticed that the sleeve of this member of the valve is "blind-ended," so that there can be no passage of water in case of wear. From many careful measurements of the discharge water under heavy work, it has been found by the makers that the volumetric efficiency of pumps fitted with these valves is frequently 98 or 99 per cent.

In the case of pumps of this construction dealing with water containing grit and foreign material, these valves are found to have considerable advantage. The mitre faces of the metallic portion do not allow grit or similar material to remain on the sloping faces, but if by any chance such material should lodge there, the rubber sealing disc will close over and make the valve water-tight in most instances. This type of valve has been used by Messrs. Evans in pumps working against heads up to 1600ft. with quite satisfactory results.

The pump described above was tested under actual working conditions and without any attempt specially to tune it up, and the following results have been furnished by the makers:—Static delivery head against pump, 632.5ft.; friction due to about 750ft. run of 7in. delivery pipe, 6ft.; vertical height of suction, 15ft.; friction through 150ft. run of 7in. suction pipe, two retaining valves and certain bends, 4.5ft. Total head pumped against from all causes, 658ft.; speed of pump crank shaft, 41 revolutions per minute; power consumption, 128 ampères at 485 volts, giving, at an efficiency for the motor of 90 per cent., 74.88 horse-power at the motor pulley; weir measurement, 330.6 gallons per minute; calculated theoretical pump displacement, 338.7 gallons per minute; volumetric efficiency of pump, 97.6 per cent.; horse-power in water raised against the total head from all causes, 65.9; showing a mechanical efficiency for the pump of 88 per cent.

At the same time, a test was carried out on a nominal 300-gallon per minute turbine centrifugal pump, working in the same house and under precisely the same conditions. The turbine pump was found to deliver 260 gallons per minute only, and the current used was 230 ampères at 500 volts, giving a mechanical efficiency therefore of only about 40 per cent. The turbine pump has been in use some years, but has had new impellers and other renewals from time to time. The Evans treble-ram pump was really designed for a head from 800ft. to 900ft., and would have shown an even higher efficiency on this latter head or if designed for the actual head at which it is now working. The motor driving the Evans pump is also at a disadvantage, seeing that it is of 150 horse-power, whereas it is only called upon to give under 75 horse-power in actual running.



SECTION THROUGH PUMP CYLINDER

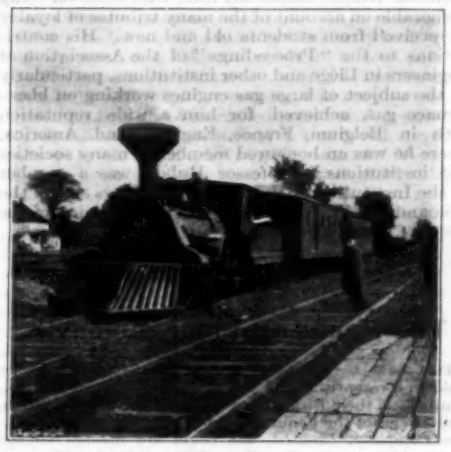
An Old British-Canadian Locomotive

(By a Correspondent.)

A British-built locomotive which was in active service in Canada for between forty and fifty years is shown in the accompanying illustration. It was one of a number of engines built for the Grand Trunk Railway of Canada during the years 1854–58 by the firm of Peto, Brassey, Betts and Jackson at their Canada Engine Works, Birkenhead. These engines were made for the old Canadian broad gauge of 5ft. 6in., and when the Grand Trunk Railway was converted to standard gauge this—the last of the old engines—was sold to the Carillon and Grenville Railway, a short line on the east or Quebec side of the Ottawa River. Here she worked in part an excursion traffic in summer for persons wishing to have the experience of "shooting the rapids" of the St. Lawrence. Passengers from Montreal by the Canadian Pacific Railway left the train at Grenville, and were carried to Carillon, on the river, by a broad-gauge train consisting of this old engine and some ancient bogie carriages having side seats like tramcars. At Carillon the passengers boarded an Ottawa River steamer which ran the Lachine rapids and reached Montreal the same evening.

About 1905 the old Carillon and Grenville Railway was acquired by the Canadian Northern Railway Company, which was then building up its system in eastern Canada, and the broad-gauge line and its equipment soon became extinct.

Some of the engines had a single pair of 6ft. driving



OLD BRITISH-BUILT LOCOMOTIVE IN CANADA

wheels, but this was one of the four-coupled type with 5ft. drivers. All were of the same general design, and were said to resemble engines built for the London and North-Western Railway, except for the mushroom-like spark arrester fitted to wood-burning engines. This attachment was applied probably by the railway at its Canadian shops. As built originally, the engines had single leading axles, but these were gradually replaced with four-wheel bogies by the Grand Trunk Railway. The American type of wooden pilot or cow-catcher was also attached. On all the engines the cylinders were 20in. stroke, but the diameters were 15in., 16in., and 17in. The smaller engines had single drivers.

As altered for Canadian service, this engine was of the four-coupled bogie type with outside inclined cylinders 16in. by 20in., driving on the first coupled axle. The valve chests, with D slide valves, were between the cylinders. Its weight in working order was about 60,000 lb. The boiler was of Low Moor iron, with barrel 48in. diameter, and had an inside copper fire-box 3ft. 6in. by 3ft. 10in., and 4ft. high. There were 170 brass tubes 1¾in. diameter and 10ft. 6in. long. The driving wheel base was 7ft., and the length of the engine was 21ft., with a total length of 38ft. 6in. for the engine and tender. The working pressure was 110 lb. per square inch.

This particular engine was described by Mr. Herbert Wallis, late mechanical superintendent of the Grand Trunk Railway, in an article on "The Centennial of the Locomotive," in the Montreal *Star* of March 22nd, 1902. At that time she was working on the Carillon and Grenville Railway. She was described also by the late Mr. Angus Sinclair in his "Development of the Locomotive Engine." But Mr. Sinclair states that both boiler and fire-box were of Low Moor iron, the latter having ½in. tube sheet and ⅝in. side and back sheets. In a letter to the writer in 1911 Mr. Wallis stated that the fire-box was of copper.

According to Mr. Sinclair's description, the regulator or throttle was a hollow brass valve of the plunger type fitted into a cast iron cylinder flanged at both ends. One flange was bolted to the inside of the back sheet of the boiler and the forward end to the steam pipe. A pipe from the dome connected with the cast iron cylinder, so that steam was admitted to the steam pipe and engine cylinders when the plug valve was drawn back. Two brass guides of the wedge type were attached to the stuffing-box flange, with the regulator handle extending up through them. As the engineman pulled the handle from left to right the inclined guides forced the valve from its seat and the pulling back of the valve admitted live steam to the dry pipe or steam pipe.

Obituary.

HERMAN VICTOR HUBERT.

By the death of Professor Herman Victor Hubert, which occurred at Spa on September 30th, we lose, not only a distinguished Belgian engineer and scientist, but one who did much to cement the common engineering and technical interests of the two countries. Born at Liége on May 19th, 1849, Professor Hubert came of a well-known Liége family, and at his preparatory school, at l'Athénée Royal and at the Liége University he showed remarkable aptitude for the course of study in philosophy, literature and engineering science which he had undertaken. At the age of nineteen years he was awarded with honours the diploma of the Liége School of Mines, and became attached to the "Corps des Mines" of the 1st Arrondissement at Mons at the early age of twenty-three years. His capacity for work enabled him, in addition to performing his mining duties, to hold the professorship of mathematics and mechanics at the Ecole Industrielle de Paturages, where he gave courses of lectures. When, in 1882, his mining duties recalled him to Liége, he was made professor of mathematics and mechanics at l'Ecole Industrielle, where he eventually became director, and his lecture courses followed those of Monsieur Dwelshauvers, the eminent professor of applied mechanics at the University of Liége. On his promotion to be principal engineer of mines in 1898, Professor Hubert took charge of several technical missions to foreign countries on prospecting and other work, and in that capacity he visited the Crimea, Spain, Sardinia, Algiers, Hungary, Holland, as well as the Caucasus and America. In 1904 Monsieur Dwelshauvers was made Emeritus Professor, and Professor Hubert succeeded him, that occasion being memorable on account of the many tributes of loyalty he received from students old and new. His contributions to the "Proceedings" of the Association of Engineers in Liége and other institutions, particularly on the subject of large gas engines working on blast-furnace gas, achieved for him a wide reputation both in Belgium, France, England and America, where he was an honoured member of many societies and institutions. Professor Hubert was a member of the Institution of Mechanical Engineers and of the Iron and Steel Institute, and was a Companion of the Order of the British Empire.

The P. and O. Liner Moldavia.

The new twin-screw passenger and cargo steamer Moldavia, recently completed by Cammell Laird and Co., Limited, at their Birkenhead shipyard for the Australian mail service of the Peninsular and Oriental Steam Navigation Company, Limited, will begin her maiden voyage on the 13th inst., sailing from Tilbury Dock. The new Moldavia, which replaces an earlier vessel of the same name, which was sunk during the war as an armed merchant cruiser, marks an interesting variation in type from the previous ships, the Naldera and the Narkunda, which have been put into service during the last two years. The principal difference is that, while in the Naldera type the main deck and the three decks above it are devoted to the accommodation of passengers, in the Moldavia—and her sister ship, the Mongolia—the passenger accommodation is above the upper deck, on the promenade, shelter and shade decks respectively. The Moldavia is a one-funnelled steel vessel of the shade deck type, with a short forecastle, and has a straight stem and an elliptical stern. Her principal dimensions are as follows:—Length, 573ft. overall; moulded breadth, 71.5ft.; moulded depth, 51.25ft. from the shade deck; gross tonnage, about 16,000 tons; deadweight capacity, 13,500 tons. Accommodation is provided for 222 first-class passengers and 175 second-class passengers on the shelter, shade, and promenade decks, in cabins having one, two, three, and four berths. The officers and engineers are housed on the boat deck, while the crew accommodation is fore and aft on the upper, shelter and shade decks. The public rooms are particularly spacious, and are furnished and decorated in a pleasing style appropriate for tropical services. In addition to ample natural ventilation, a system of electrically operated fans is installed. There is a cellular double bottom running fore and aft, and safety conditions both with regard to the possible damage which might result from fire or collision have been given careful consideration. Water-tight bulkheads fitted with sliding doors which may be hydraulically operated or hand controlled are fitted throughout the ship, and five fire-resisting bulkheads are built in the ship. Thirteen large lifeboats, operated by Welin davits and having accommodation for the full ship's complement, are carried, and an oil engine-driven dynamo for emergency lighting and wireless service is placed on the boat deck.

There are seven cargo holds with main and upper 'tween deck cargo spaces and two holds and 'tween decks Nos. 1 and 5 are insulated for carrying refrigerated cargoes of Australasian produce. Two sets of refrigerating machinery, with air coolers and fans are provided for circulating brine and air in the insulated holds and cold chambers. Eighteen steam winches and twenty-three derricks, including one for 30-ton lifts, are arranged for working the cargo, while a steam windlass and two steam capstans are placed on the forecastle deck and two steam capstans aft on the shade deck.

The auxiliary plant for supplying electric light and power consists of five steam-driven dynamos installed at the aft end of the main engine-room. The main propelling machinery is of the twin-screw double-reduction geared turbine type with Michell thrust bearings, and the power developed is designed to give the vessel a speed of 16 knots. The boiler plant comprises three double-ended and four single-ended marine boilers placed in one boiler-room. The machinery was constructed by Cammell Laird at their Birkenhead Engine Works, under the supervision of Mr. R. Leslie, the company's superintendent engineer.

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

GLIDERS.

Sir,—While modern progress makes it difficult to prophecy, it is as difficult to see any reversal of well-known mechanical laws that can make the glider anything but an experimental machine, whose somewhat risky use is possibly the super training of pilots.

Considered from any angle literally and metaphorically, here is a structure heavier than the medium which supports it, attempting to emulate the achievement of the sailing boat with the third dimension added and without the lateral resistance of a heavier medium to supply the component of the necessary resultant force to maintain its elevation. It is, in short, a kite, the string of which is replaced by the conservation of gravitational force in a diagonal descent. When an adventitious "puff" enables an unusual degree of the original elevation to be maintained, the lay Press breaks out into the possibilities of the "motorless aeroplane," and might just as well go into rhapsodies over a man crossing the Channel in a lifebelt.

No doubt the effortless flight of the greater gulls is very encouraging, and if it has not been made the subject of the slow cinema, it certainly should be at once; but in this case we do not know what upward currents may not be available from the deck of a moving vessel, and either back draught from sails, or heated air from furnaces and hot deck planking may serve to assist a creature whose instinct is in direct control of his "aerilons."

Apart from that, there may be vibratory movement of the extended wings too rapid for human sight to register. The slow cinema should assist here. One thing, however, should be tolerably certain. Without the expenditure of "work," no structure heavier than the medium on which it is borne and whether living or inanimate can maintain its elevation and proceed horizontally by any process of angling its planes to the air currents and for an indefinite period.

Since we have made a tolerable success of flying by means of the light petrol prime mover to supply this "work," it is very difficult to see the use of returning to century-old experiments fraught with grave danger to valuable flying lives, and the mechanics of which are an open book, and always have been.

"Enquirer," I think, too, is a little unfair to Nature in claiming the wheel as man's invention. Strictly speaking, he may be correct, but the dung-rolling beetle of South Africa, and I believe other countries, solved the problem of transport by shaping his load into a sphere and trundling it along with his hind legs, and this is surely a very good pointer toward the wheel. The humble hedgehog, too, will roll himself down precipitous places that his short legs cannot negotiate; while as to the screw propeller, it is merely a rotary adaption of the fish's tail, and probably far less efficient when the fine feathering action of the live membrane is closely studied. No fixed blade formation can ever equal it.

If it is argued that man may by dint of improved glider design eventually supply the necessary "work" to maintain himself in the air by his own efforts, with safety and without the aid of gas bags, &c., it should be borne in mind that for his average weight man is about the weakest of the animals, and what efforts he can put up as against creatures designed by nature for flight is hardly worth consideration.

Some years back, one of the admitted leaders of political thought in this country assured me that he knew of a boat which proceeded up stream by no other power than the adverse force of the current against it, and became quite heated when I denied the possibility. The glider position is much the same, but the world is so full of lies of all sorts to-day that at least a straightforward examination of the mechanical facts may not be out of place. Even the exact sciences are becoming somewhat "ectoplastic,"* thanks to the semi-education of the lay Press, and the desire to supply the public with sensation at all costs.

October 2nd. A Dubious Scot.

Sir,—Replying to "Enquirer's" remarks in connection with my previous suggestions on the subject of propulsive methods for gliders and aeroplanes, I am glad, in the first place, to note that he has apparently an open mind on the matter. On the other hand, he has drawn quite a false analogy in comparing wheels *v.* legs with propeller *v.* wings. Legs still form and provide the best and only method of progress over ground on average and natural conditions of roughness, and wheels are useless without the equally artificial preparation and levelling of ground surfaces. Wings and propellers have, on the contrary, to deal with the same element and conditions, namely, the air, over which we have no power of preparation or regulation. The case for wings surely is amply proved, whilst the waste of power and lack of proper control in motor-driven fan propellers is or should be very obvious. Your correspondent asks for figures based on experiment. If such figures do not already exist, here, then, comes the opportunity which I have suggested, if gliders were to be fitted with apparatus which would operate on the principle of wings, not necessarily a slavish imitation of such. The action of a fish's tail in the water could, of course, only be practically applied where under direct human control, in the form of a single rear sculler from a boat.

My suggestions were not intended to represent what was finally the high road to solution, but it, nevertheless, remains for someone to indicate a better way, if such exists.

October 3rd. Economist.

FLOOD DISCHARGE AND THE DIMENSIONS OF SPILLWAYS.

Sir,—I have read with much interest Mr. Williams' paper in your last issue. While generally agreeing with his views, I do not think he attaches sufficient importance (*a*) to the condition of the watershed and (*b*) to the distribution of the rainfall. If the ground is in a saturated condition, a comparatively light fall will produce a much heavier flood than a heavier one at the beginning of the monsoon. Thus, in one case in my experience, with a fall of 3¼in. only 43 per cent. ran off, whereas in another case out of 20.6in., 97 per cent. were accounted for.

While engineer of the Bombay waterworks, I kept daily records during the monsoon of the falls, and the percentages received in the lakes. The Tulsi watershed, which is very steep and covered with jungle, has an area of 1700 acres, the rainfall varying from 44in. to 144in., the mean being 103.8in.; the amount received in the lake averages 65 per cent. The Tansa watershed, of 52¾ square miles, has a much smaller average inclination, the rainfall varies from 40in. to 120in. and averages about 109in., with a run off of about 50 per cent. I have given the records of a series of years in the discussion of Mr. Jones' paper on the Madras Waterworks, published in the "Proceedings" of the Institution of Civil Engineers, Vol. cxxxvii.

The greatest difficulty in arriving at the true rainfall of watersheds such as those supplying Bombay, consists in the inaccessibility of the higher points, where no doubt the precipitation is much heavier than those where the rain gauges are actually placed.

Ealing, October 2nd. A. Fairlie Bruce.

FILING DRAWINGS.

Sir,—As a draughtsman of nearly thirty years' experience, during which I have had to handle drawings prepared by most of the large engineering firms in this country, I have often been struck by the waste of time caused by the lack of uniformity in titling and numbering the drawings. In many cases the titles are placed in any spare corner, and as regards numbering, most firms have their own particular system, the number being frequently faintly written in manuscript on a rubber stamp imprint placed in another odd corner. It is often doubtful whether the quoting of this number would be sufficient to identify the drawing.

Considerable time would be saved in recording, handling, acknowledging, &c., the drawings if both the title and the number were placed in the right-hand bottom corner of every drawing. Also if a universal system of "initial and numeral" numeration were adopted similar to that used for motor cars, each firm using distinctive initial letters which could be recognised and registered by the various engineering institutes. Thus in correspondence, &c., when required to quote drawings, instead of having to refer to, say, "drawing received with Messrs. Jackson, Brown and Co.'s letter of so and so date," it would be only necessary to quote, "drawing No. J.B. 4057." In dealing with a batch of twenty or thirty prints, the saving of time is obvious.

The American, French, and Japanese navies have standardised systems for their drawings, both as regards titling, &c., and also for folding them. Large drawings are folded to a standard size in concertina fashion, so that the title is uppermost, and also so that any part of the drawing can be at once opened out in a small space, similar to a motorist's road map. I am afraid, however, that the universal adoption of this latter idea in this country would be too much to expect from we conservative Britons.

September 18th. W. G. G.

*With all apologies to the Spiritualists for trespassing on some of their jargon.

PROPOSED NEW FREEZING WORKS AT ROSARIO.

It is reported from Buenos Aires that arrangements are being made for the formation of a big company to establish an extensive freezing works at the port of Rosario to engage in the direct export of chilled beef to France.

In an appeal to the Federal and Provincial Governments, for aid for the scheme the promoters point out that though Rosario is the natural outlet for the production of an extensive zone of some of the richest pastoral land in the Republic, not a pound of meat is exported from that centre. All the cattle from the Provinces of Santa Fé, Entre Rios, and the west of Buenos Aires, are sent by rail to Buenos Aires for slaughter, the meat freezing and export industry being centralised in the Federal capital.

It is proposed to form a company with a capital of 15,000,000 dols., the shares to be taken up by the pastoralists, the Federal and Provincial Governments, and the rural societies. The Banco de la Nacion is to be asked to advance 5,000,000 dols. at 6 per cent. to enable the bar at Martin Garcia, on the Paranà River, to be dredged to a depth of 27ft. so that the largest foreign refrigerated steamers may reach the port of Rosario and load direct for Europe. The board of directors is to be formed as follows:—Three from the Argentine Rural Society; two from the Rosario Rural Society; two from the Banco de la Nacion; and one each to represent the Governments of Santa Fé, Cordoba, Entre Rios and Corrientes.

The promoters assert that the recent increase in railway freights imposes a heavy charge on the transportation of live cattle from the outlying districts to Buenos Aires, and that freezing works at Rosario would enable the pastoralists to get better prices for their stock.

It is proposed to introduce a new power plant in the district of Branca, Province of Perugia, Italy, to utilise the national supply of lignite. The Government has undertaken to subsidise such an installation, provided it has a minimum capacity of 15,000 kilowatts, divided into three units of 5000 kilowatts each, two for regular use and one for reserve. Lignite, which is produced to almost any extent in Italy—the estimated production for 1922 is put at 1,840,000 tons—will be employed, the consumption being estimated at 150,000 tons per annum, while the by-products, amounting to 3000 tons of ammonium sulphate and 2550 tons of tar annually, will be marketed. The Government's offer includes a subsidy for twenty years, fixed at 130 lire per kilowatt installed, or a total of 1,950,000 lire. The Società Lignitifera Umbra, which possesses the exploitation rights on lignite deposits, will accept the Government concession and install the new electric plant.

A Seven-Day Journal.

Another Michelson Experiment.

The interesting news comes from America that Professor A. A. Michelson, of the Department of Physics, University of Chicago, is in process of repeating at the Mount Wilson Observatory, California, the celebrated Michelson-Morley experiment which in 1881 startled scientists the world over and laid the foundations for Einstein's work on relativity by demonstrating that the effect of the earth's orbital motion on the velocity of light could not be measured. If the luminiferous æther is stagnant and if light has a fundamental velocity of its own through it, then, since the earth is moving orbitally through the æther at a speed of about 18 miles a second, a beam of light travelling against the earth's motion from a point ahead should reach us in a shorter time than a beam of light travelling with the earth's motion from a point at an equal distance behind. In the Michelson-Morley experiment of 1881 a single beam of light was split up into two portions, which were sent on divergent paths and then re-united, and from the interference bands developed by the reunion it should have been possible to measure the velocity of the earth relatively to the æther. The apparatus was sufficiently delicate to detect a velocity of 2 miles a second, but it failed completely to disclose the much larger known velocity of the earth. Professor Michelson, it is reported, is now making arrangements to repeat the experiment on a large scale by passing two beams of light in opposite directions round the sides of a square, each side measuring a quarter of a mile, and by endeavouring to measure the difference in the times of their return with the object of determining the effect of the earth's polar rotational velocity—not orbital velocity, as before—upon the velocity of light. In order to eliminate atmospheric interference the sides of the square are to be made of steel piping 1ft. in diameter and carrying a vacuum.

The Shipbuilding Outlook.

Some very welcome orders continue to be received in the shipbuilding industry. In addition to the large motor passenger liner which, as mentioned below, the Fairfield Company is to build for the Union Steamship Company of New Zealand, for service on the New Zealand-Vancouver route, other work recently placed with the Clyde shipyards includes a 6000-ton fruit carrier for Elders and Fyffes, to be built by A. Stephen and Sons, and three 8000-ton steamers, to be built by Lithgows, Limited. Two Elders and Fyffes' fruit carriers are also to be laid down by Cammell-Laird at Birkenhead, while at Belfast Workman Clarks are to resume operations on an Ulster Steamship Company's vessel on which work has been suspended for over twelve months and have just laid the keel of a 10,000-ton coal-carrying ship. Meanwhile in labour matters the position seems to be improving. The result of the ballot of the workers on the employers' proposal to withdraw the remaining 10s. of the 26s. 6d. war bonus may probably be made known to-day (Friday). It is not anticipated that the men will be found to have recorded a majority either for a strike or for an acceptance of the cut, but that they will have chosen the third alternative—empowering their representatives to secure the best possible terms, which are to be submitted to a further vote later on. It is understood that, in the case of some of the orders placed recently, on the Clyde at any rate, the contract prices have been fixed on the assumption that the proposed cut would be accepted by the men.

Railway Management.

In his address at the third annual meeting on Monday of the Institute of Transport, Sir Sam Fay, general manager of the Great Central Railway, had a good deal to say on the subject of railway management as affected by the new grouping scheme. Success or failure, he remarked, would depend upon the atmosphere created by the management. Ultimately, in his view, the larger groups serving the industrial centres would be forced to adopt an organisation for their management similar to that found in the United States and Canada. Under such an arrangement there might be an executive chairman, a first vice-president with expert knowledge of finance, a second vice-president dealing with operation, a third representing the commercial side, and a fourth specialising in legal matters. Acting in conjunction with such a management there would be three or four divisional superintendents for each group, who, with technical assistants, would be responsible within their alloted areas for operation, for maintenance and renewal of line and rolling stock, and for the conduct of commercial business. He believed that it was essential to avoid centralised detailed administration and to develop direct local contact with traders and the travelling public. Meanwhile speculation is being indulged in as to who will receive the general managerships of the new groups. While in some instances, such as that of the Great Western Group, for which Mr. Pole seems destined, the choice seems clear, in others, notably that of the South-Western, Brighton and South-Eastern Group, there is considerable room for difference of opinion as to who is likely to be appointed.

A Structural Engineering Institute.

Soon after the Concrete Institute was established it was realised that the scope of its interests extended considerably beyond the field of concrete and reinforced concrete, for the study of which it was brought into being. Structural work in general engaged its attention, so much so that the Board of Trade called the Council's attention to the fact that the Institute was exceeding the objects set forth in its articles of association, and that as a consequence, if it desired to continue to do so, it would be necessary for it to change its title. A change of name was under contemplation when war broke out, but the matter was not carried any further in view of the difficulties of the times. At a meeting of the Institute last week the subject was debated at considerable length, with the result that in spite of some opposition, a motion was eventually carried by a large majority that the title should be altered to the Institution of Structural Engineers. Those objecting to the change did so on the ground that structural engineering is already adequately covered by certain other institutions, and that the concrete and reinforced concrete profession would suffer a loss of prestige if it were regarded merely as a section of the structural engineering profession.

Wireless Broadcasting.

The difficulties encountered in the formation of a company to undertake wireless broadcasting in this country would now appear to have been satisfactorily overcome, and within a week or two, it is expected, broadcasting will be begun in the London district. The broadcasting company has been formed and has received the approval of the Postmaster-General. Its capital is understood to be £100,000, and has been guaranteed by the Marconi, the Radio Communications, the Metropolitan-Vickers, the British Thomson-Houston, the General Electric, and the Western Electric Companies. Any other British firm desiring to join the Broadcasting Company may do so by taking one share and agreeing to pay 10 per cent. of the sale price realised for its wireless receiving apparatus. The Broadcasting Company, in addition to receiving subscriptions from its members in proportion to their sales, is to be given half the fees obtained by the Government for the issue of its wireless licences.

The South-Eastern Electrification Scheme.

In connection with the electrification of its North Kent, Mid Kent and other suburban lines, the South-Eastern and Chatham Railway proposed to construct a generating station at Angerstein's Wharf, Charlton. For the purpose of constructing that station and for carrying out the electrification work on the 220 miles of track involved in the conversion a subsidiary company, the South-Eastern and Chatham Construction and Power Company, was formed with a nominal capital of £10,000. The sanction of the Electricity Commissioners to the construction of the proposed power station was duly sought. Their final decision has now been announced, and is definitely against the scheme being carried out. The Commissioners say that no greater risks would be incurred by the railway taking an outside supply than by its generating its own energy, and that by relying on an external source it would save on the cost of energy and would avoid incurring capital expenditure amounting to over a million pounds sterling. The terms offered by the West Kent Electric Company, the County of London Electric Supply Company, and the London Electric Supply Corporation are favourable, the Commissioners state, and by June 30th, 1925, by which date the electrification scheme should be completed, one or other of these companies, they are satisfied, would be in a position to give the railway the necessary supply of energy. The construction of a power station by the company is not regarded as in any way essential to the electrification scheme, and, moreover, would, in principle, defeat the object aimed at in the reorganisation of electricity supply under the Electricity Supply Act of 1919. It is to be noted that both the North-Eastern and the London and Brighton Railways draw their supply of energy from outside sources and are quite satisfied with the arrangement.

The Largest Motor Liner.

The 600ft., 18-knot motor passenger liner which the Fairfield Company is to build for the New Zealand-Vancouver service of the Union Steamship Company represents a distinct step forward in the development of the motor ship, for she is to be equipped with engines developing 12,000 brake horse-power, or about twice as much as those in any motor vessel so far built. The machinery, we are in a position to state, will comprise four six-cylinder two-stroke cycle Fairfield-Sulzer engines, each set developing 3000 brake horse-power and running at 135 revolutions per minute. The cylinders will have a diameter of 27in. and a piston stroke of 39in. The scavenging air will be supplied by three electrically driven turbo-blowers of such size that two will supply all the air required by the four main engines. The auxiliary machinery will include four two-stroke cycle Sulzer engines developing 400 brake horse-power each, at 200 revolutions, and will be direct coupled to dynamos. The main engines will be built in Glasgow by the Fairfield Company under licence from Sulzer Brothers, who will supply the drawings and certain parts. The auxiliary engines will be constructed at Winterthur.

A Kent Coalfield Deal.

It is reported that Dorman, Long and Co., Limited, of Middlesbrough, are in negotiation for the purchase of about 20,000 acres of coal-bearing land in Kent from the Kent Coal Concessions and other companies. The Middlesbrough firm recently acquired a large area of land near Deal, which is believed to carry an extensive deposit of ironstone, and is stated to have an interest in the Channel Steel Company, which owns reputed ironstone-bearing land between Folkestone, Dover and Deal. Opposition to the sale of the coal lands on the terms offered for their purchase is being expressed.

The Over-production of Rubber.

The final draft of the supplementary report of the Colonial Office Committee on Rubber has, it is understood, been under consideration by that body and will be duly presented to Mr. Churchill in a few days' time. The recommendations made in it for relieving the situation in the rubber growing industry, which has arisen as a result of increased production coupled with a decreased demand, will, it is rumoured, cover some novel proposals of a far-reaching nature. Meanwhile we note that at least one rubber manufacturing company is endeavouring to find an extensive new outlet for its products. It is announced that the North British Rubber Company has offered to supply rubber paving blocks to the Edinburgh Town Council free of charge for the purpose of experiment on the streets adjoining the company's works. The Town Council has agreed to accept the firm's offer, for it hopes thereby to receive help in solving the problems of roadmaking. In the early days of the industry the rubber pavement was regarded as one of the principal and most promising possible outlets for the material, but high costs and more profitable demands from other directions combined to render the idea impracticable except as a luxury.

Proposed Association of Engineering Societies.

At a meeting last Friday afternoon at the Engineers' Club, London, convened by the Society of Engineers, a proposal was discussed to form an Association of British Engineering Societies. Those responsible for the proposal extended an invitation to join the Association to twenty-one of the minor engineering and allied societies, including the Institutions of Automobile, Gas, Heating and Ventilating, Mining, Municipal and Water Engineers, the Concrete Institute, the Royal Aeronautical Society, and the local institutions at Birmingham, Bristol, Cleveland, Liverpool and Manchester. It was proposed that, while the constituent societies should retain their independence, the Association should bring them into touch and promote co-operation between them. At last Friday's conference the proposal that the Association should be formed forthwith was not carried, but after considerable discussion it was resolved that the suggestion was sufficiently important to justify the appointment of a committee to consider it and to submit detailed proposals to the societies concerned. The committee elected for this purpose consists of representatives of the Women's Engineering Society, the Society of Technical Engineers, the Technical Inspection Association, the Institution of Sanitary Engineers, the Society of Engineers, and the Gloucestershire Engineering Society. The new Association, it is held, will not compete with the Joint Council recently formed by the Civils, Mechanicals, Electricals and Naval Architects, but will rather co-operate with and assist it in its work.

Locomotive Building in India.

Early in 1921 a group of influential Indian gentlemen invited Kerr, Stuart and Co., Limited, to form a company in India for the purpose of manufacturing railway locomotives. In their annual report to be submitted to the shareholders on the 13th inst., the directors of the company state that they have decided to accept this invitation after having fully considered and investigated the position. An undertaking known as the Peninsular Locomotive Company has been formed, the capital having been subscribed privately in India. The production of locomotives on an extensive scale is expected to begin shortly.

The Wireless Exhibition.

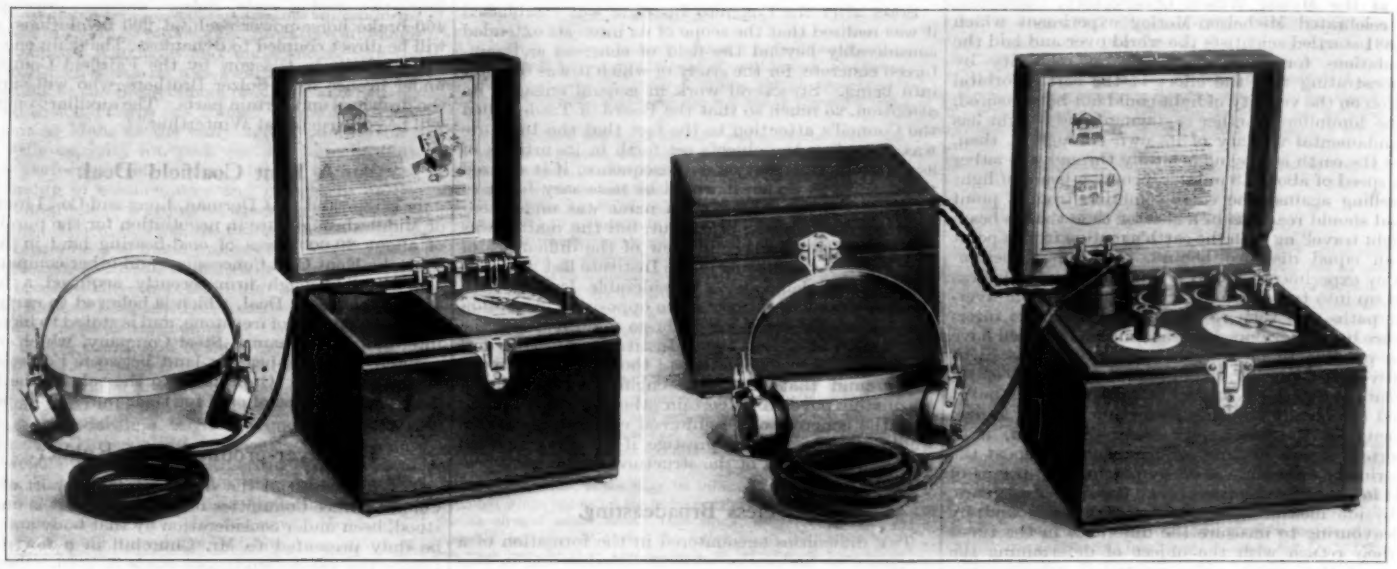
The Wireless Exhibition, which was opened at the Royal Horticultural Hall on September 30th, and which closes on the 7th of this month, is the outcome of the progress that has been made in wireless telephony. Since it has become possible to transmit speech and music through the ether, interest in wireless affairs has greatly increased, and there seems to be no doubt whatever that the wireless telephone will shortly be used on a very large scale for the amusement and instruction of the public. The fact that leading electrical firms such as the British Thomson-Houston Company and the Metropolitan-Vickers Electrical Company have made elaborate preparations for the supply of receiving sets and the broadcasting of entertainments indicates pretty clearly that a big wireless business is contemplated. Although broadcasting has been delayed much longer than many who have taken out licences and purchased or made receiving sets expected, it appears from a speech delivered by Sir Henry Norman at the opening of the exhibition that the long-promised transmissions will shortly commence.

Wireless telephony offers considerable scope for research, for although it is possible with proper apparatus to receive good speech and music over a fair number of miles, there are various problems which remain to be solved. The recent official report on the subject, with which we dealt in our issue of August 11th of this year, showed conclusively that the possibility of using the wireless telephone on a commercial scale for long distances is somewhat remote. Even for short-range work the wireless telephone has several disadvantages which render it unsuitable for general commercial communication. At present, at any rate, the principal use of wireless telephony would seem to be in connection with the broadcasting of music and news, although there are, as we have previously pointed out, possibilities in other directions. Received on a good pair of head telephones, music and speech are quite satisfactory, but we have not as yet met with a loud-speaking receiver which gives really good results. Naturally the exhibition is devoted very largely to the receiving side of wireless telephony, for transmitting licences are not at all easy to obtain, and it is to the sale of receiving sets that the wireless firms are mainly giving attention.

For the benefit of our readers who are not versed in wireless affairs we should explain that there are two distinct kinds of wireless receivers—crystal and valve receivers. The former has the advantage of extreme simplicity, for it requires no batteries or other arrangements that are liable to get out of order. The range of the crystal receiver is, however, about 10 or 11 miles. Some firms specify that their crystal sets are suitable for considerably longer distances, but the Marconi Company, which should be in a position to judge the capabilities of this type of receiver, fixes the distance for good reception at 10 miles, although there is no doubt that that range can be considerably increased under favourable conditions. The simple crystal detector wireless receiver consists of a variable inductance and a variable condenser, and the crystal detector and telephones which are shunted by a fixed condenser are connected across this adjustable oscillation circuit, which is tuned to the incoming wave length. The oscillations of each wave group are rectified, and pulses of direct current pass through the telephone receivers, the rectification of the varying oscillatons obtained when receiving resulting in speech sounds being heard in the telephone receivers.

A crystal receiving set exhibited by the Metropolitan-Vickers Electrical Company is shown in Fig. 1. This set, like many shown by other firms, has been specially designed for the reception of telephony broadcasted from the British broadcasting stations which are shortly to be put into operation. The aim of the makers has been to produce the most efficient sets possible for this particular purpose and their operation calls for no technical knowledge. The range of the set is 10 miles. Among other firms showing crystal sets are the Wireless Supplies Company, the West London Scientific Apparatus Company, Limited, the Radio Service Company, Limited, the B.T.H. Company, T. H. Isted, Fellows Magneto Company, Limited, Craies and Stavridi, Water Bros., Mitchell's Electrical and Wireless Company, Marconi's Wireless Telegraph Company, the General Radio Company, A. W. Gamage, Limited, Sterling Telephone and Electric Company, Radio Instruments, Limited, Leslie McMichael, Limited, the Western Electric Company, Limited, and Siemens Brothers and Co., Limited. Many of these firms are also showing valve sets. The valve set shown in Fig. 2 is also exhibited by the Metropolitan-Vickers Electrical Company. This is suitable for distances up to 50 miles or more, and by the addition of a note-amplifying attachment, the range may be increased, when using head telephones, to 200 miles, or a loud-speaking telephone may be used at distances up to 50 to 100 miles. A mains attachment is also shown, by means of which the currents required for the filaments and anode circuits of the valves may be derived from a direct-current electric lighting supply, thus entirely dispensing with the use of batteries. An exhibit on the company's stand which is creating much attention is a model of the proposed aerial which is to be erected at the company's Trafford Park works, the model is shown in Fig. 3, which also illustrates the research buildings in which the wireless experimental work is being carried out.

It is well known that the thermionic valve may be used for detecting, amplification, and transmitting. Valve receiving sets may be composed of one, two, three, or more valves. A single valve may be used as a detector and amplifier, but most sets of this kind are composed of at least two valves. Many schemes have been devised for reception. In some cases the incoming signals are first amplified at radio frequency, and then passed through a detector valve, and amplification then takes place at audio frequency. It is considered by some firms, however, that high-frequency amplification is liable to prove unsatisfactory in the hands of inexperienced workers, and a form of receiving set which is being offered by a fair number of wireless manufacturers for the reception of broadcasted transmissions is composed of a detector stage and a low-frequency amplification stage. A set designed on these lines, but possessing novel features, is being offered by the British Thomson-Houston Company, and Fig. 4 is a diagram of connections. The receiver is contained in a polished wood case, measuring about 13in. by 14in. by 5in., and weighing 20 lb. complete. The cover can be lifted off its hinges and has fixed to it a central pivot. The case is fitted with a corresponding socket in the base which fits over the pivot and thus allows the whole set to be turned round in a vertical axis to any desired position,



FIGS. 1 AND 2—METROPOLITAN-VICKERS CRYSTAL AND VALVE WIRELESS TELEPHONY RECEIVING SETS

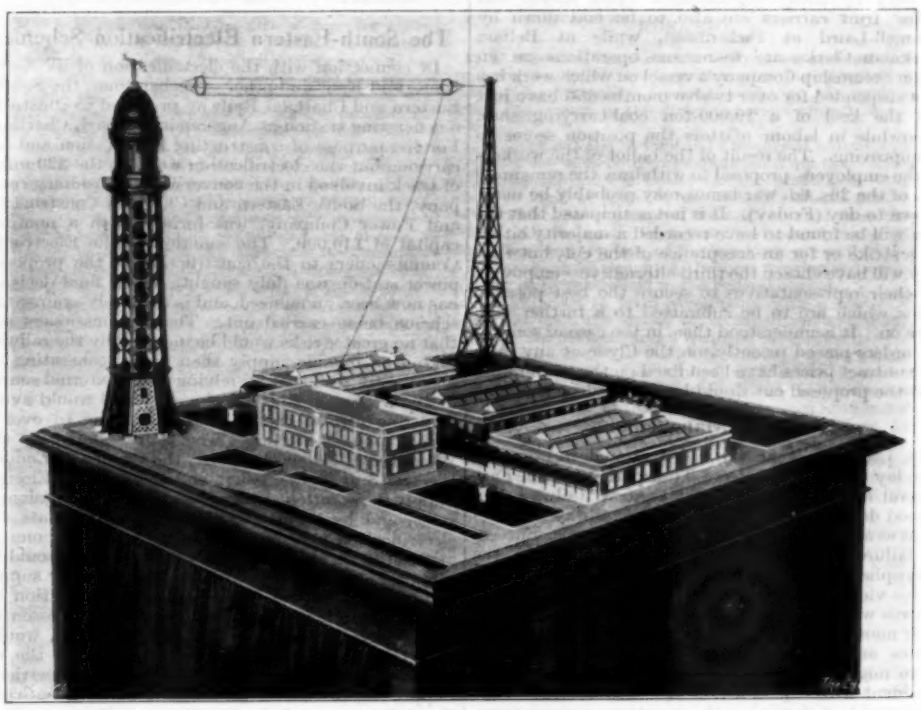
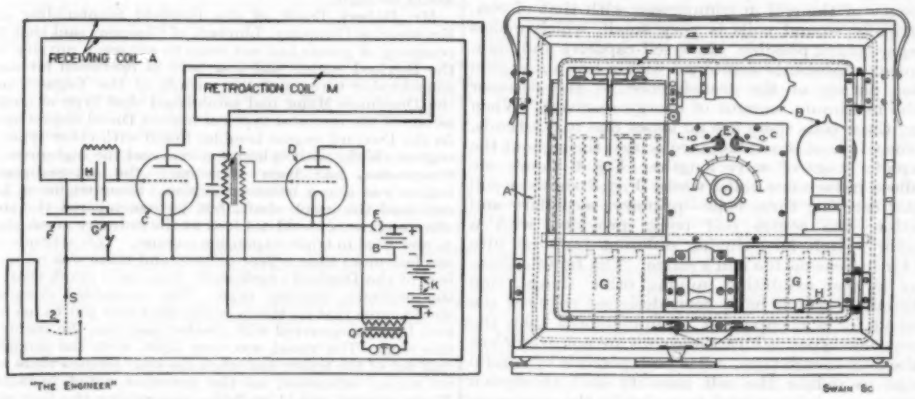


FIG 3—MODEL OF METROPOLITAN-VICKERS PROPOSED AERIAL

whilst a pointer hinged to the base of the case indicates on a circular scale the direction from which signals are being received.

When using the instrument the case is placed upon the pivot and the telephone leads are inserted in clips. A plug is also inserted in a socket, when the filament circuit of the valves is completed. The case is then rotated on its pivot until the pointer indicates on a compass scale the direction of the station it is desired to hear. The adjustable condenser knob is then turned until its pointer indicates the wave length of the desired station and the hinged coil is then moved outwards until the signals from the station are heard. The receiving coil A which is acted upon by the passing waves is wound on a frame surrounding the apparatus, and there is an air space between the coil and the outer case. An accumulator B of the unspillable type heats the filaments of the two valves C and D when the plug is inserted at E, whilst a high-tension battery K provides a voltage for the plate circuit of the valves. The receiving coil A is tuned to resonance with the frequency of the passing waves by means of the condensers F and G, the latter being used for high wave lengths when the switch S is on the contact 2. A small capacity H shunted by a high resistance enables the high-frequency electromotive force generated by the coil A to charge the grid of the valve C negatively.



FIGS. 4 AND 5—CONNECTIONS AND ARRANGEMENT OF B.T.H. VALVE SET

The detecting valve C receives pulses of high-frequency electromotive force from the receiving coil and transforms them into low-frequency pulses which pass into the transformer L, which transforms the low-frequency electromotive force up to a suitable value for the amplifying valve D, in which the signals are amplified and transmitted to the telephone transformer Q, the telephone receivers T being connected to the secondary of this transformer. The retroaction coil M, which is connected in series between the plate of the first valve and the primary of the transformer L, enables the loudest and best signals to be obtained by adjusting its position with respect to the coil A.

The arrangement of the parts within the case is shown in Fig. 5. A is the receiving coil which is wound upon the inner frame of the case, B the two valves, C the 4-volt accumulator for heating the valve filaments, D a tuning condenser, E two small switches for the inductance and capacity, F the hinged retroaction coil on the frame, G the dry cells, H the plug for the filament circuit, and J the telephone connecting clips. The B.T.H. portable receiver is claimed to be the only self-contained receiver which is able to pick up the numerous time signals, weather forecasts, Press reports and other interesting daily messages from the large European stations without connection with an aerial or earth wires. For "listening in" to broadcasted transmissions the set is also claimed to be very suitable, for it can easily be moved from one room to another, and excellent results are said to be obtained within a 5-mile radius of a broadcasting station. The set can, however, be used in conjunction with an aerial, amplifiers or other additional apparatus when the working range can be greatly increased. For those who only require a set for the reception of broadcasted transmissions the company has designed a cheaper receiver of the crystal type. This has many unique features, one of the most important being the provision of two crystals, so that if one of the crystals is jarred out of operation the other will continue to receive. Like the valve sets, the crystal receivers may be operated alone or may be combined with the firm's high-frequency or low-frequency amplifiers. The B.T.H. high-frequency amplifier is self-contained, with all the necessary working parts, such as the valve, accumulator, high-tension battery, and all the connections ready for operation.

The exhibit of Marconi's Wireless Telegraph Company, Limited, consist, among other things, of several pieces of historical apparatus which serve to show the advance which has been made in wireless science during the past twenty-five years. There is also a number of the company's latest wireless instruments. The latest pattern wireless direction finder, as installed at the London air port for the Air Ministry, and as used by the British Post Office, and in numerous foreign aerodromes, is shown. It is specially designed for use on land in connection with the navigation of ships and aircraft. It provides a means for accurately determining the plane of received signals and the absolute direction of reception. The sensitiveness of this instrument is such that it may be used for ordinary reception with satisfactory results, and in this connection its directional properties are of very considerable value in the presence of "jamming." Change from directional reception to uniform all-round reception can be brought about instantaneously by the operation of a single switch, and the circuits are equally suitable for the reception of spark, tonic train signals, telephony, or continuous-wave signals. The wave length range lies between 300 m. and 4500 m. In conjunction with this instrument the Marconi aircraft wireless telephone transmitter is shown, and the type A.D. 2 receiver, as fitted to every regular British commercial aeroplane flying between London and the Continent and to numerous machines operating in Japan, Siam, China, Newfoundland, Mexico, Brazil, Argentina, South Africa, Chili, Spain, Switzerland, Holland, Belgium, Jugo-Slavia, Greece, Norway, Denmark, Sweden and Italy. This set is primarily designed for wireless communication—telegraphic or telephonic—between aircraft and land stations or to other aircraft. Its chief characteristic is that it combines in one box both transmitter and receiver, connected permanently by cables to a small unit which carries all the handles necessary for controlling the set. This small unit can be mounted near the hand of the user, while the set can be stowed permanently away in the most convenient position.

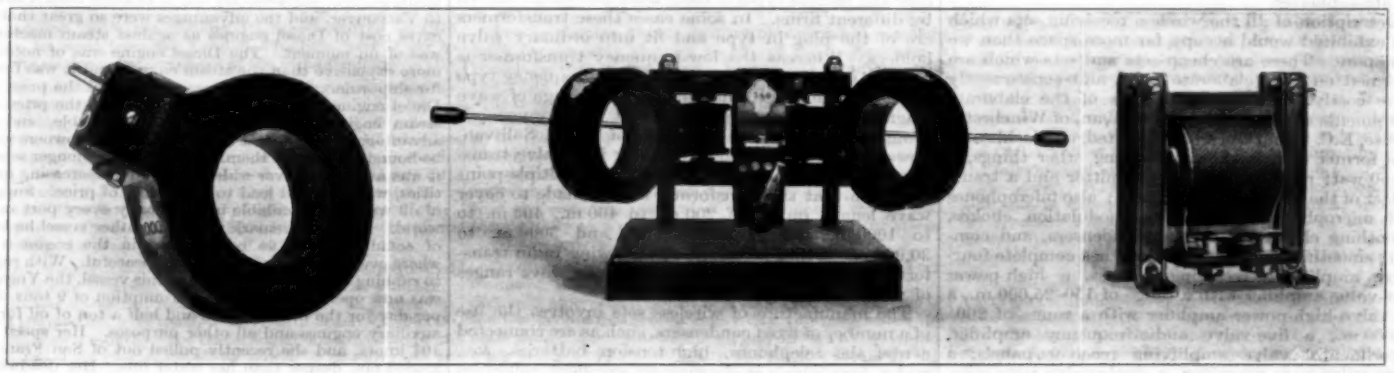


FIG. 6—IGRANIC TUNING COIL

FIG. 7—TUNING COILS MOUNTED ON STAND

FIG. 8—INTERVALVE TRANSFORMER

The remote-control system enables a pilot, while flying, to have all the necessary adjusting gear, for both sending and receiving either by telegraphy or telephony, in a very compact space. A small wind-driven generator supplies the power for transmission.

There are several types of Marconiphones on view. These are special instruments designed by the Marconi Company for the reception of broadcasted telephony in the home. The popular models include a two-valve receiver known as type V.2, and two crystal receivers known as the crystal "A" and the Crystal Junior. The V.2 model has been constructed to meet the new Post Office requirements, which specify that the receiver must be incapable of radiation. Reaction is not employed, but a throw-back circuit is utilised, by means of which additional low-frequency magnification is obtained. The "grid condenser" method of rectification is employed, and a novel method of

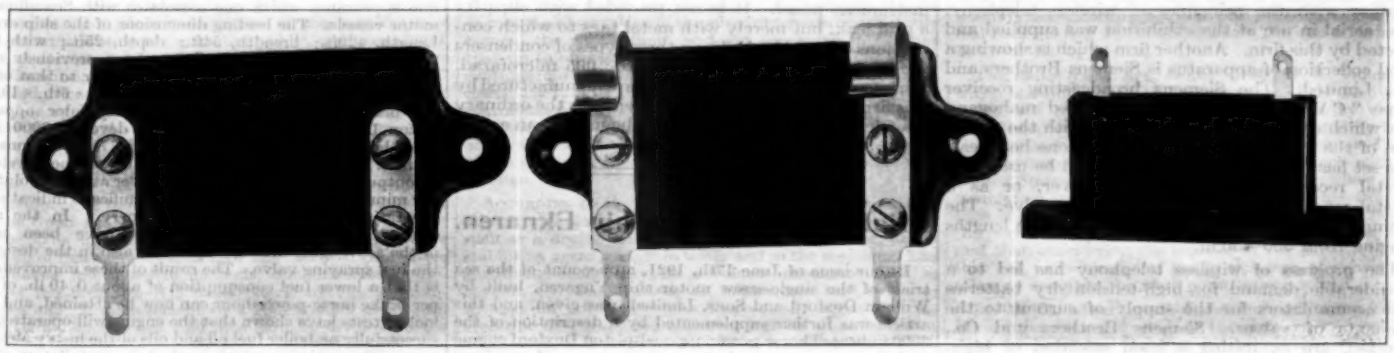


FIG. 9—DUBILIER CONDENSER

FIG. 10—CONDENSER WITH CLIPS

FIG. 11—VERTICAL TYPE OF CONDENSER

tuning is used in which the inductance of a fixed coil is varied by means of a copper spade. The inductance units are interchangeable. The set has been desgined so that either "R" or "Dull Emitter" valves can be fitted, the latter permitting the set to be operated with dry cells instead of accumulators. This receiver has a guaranteed range of 50 miles from a broadcasting centre, on the broadcasting wave lengths.

The Marconi A type crystal set is fitted with two types of crystals, galena and carborundum. It is fitted with the same system of tuning as the V.2 type set, and there is an automatic adjustment for the carborundum crystal. Provision is made for the use of two pairs of telephones. The range of the instrument is from 10 to 12 miles. The Marconi Crystal Junior set has two interchangeable crystals, galena and carborundum, with automatic adjustment for the latter. It has a single circuit tuning system, which operates in accordance with the "spade" method, and the range is from 10 to 12 miles.

The Marconi Scientific Instrument Company, Limited, is displaying a comprehensive selection of its manufactures both for the amateur and commercial markets. The Marconi scientific unit system, which has been modified to conform with the recent regulations made by the Post Office authorities, is being brought to the notice of visitors. The modifications are confined to the high-frequency stages, and constitute the use of tuned anode circuits, which give the maximum amplification possible throughout the full range of wave lengths in general use. Retroaction and the generation of local oscillations for autodyne reception is secured by means of a magnetic coupling which links the detector anode circuit to the anode circuit of the initial high-frequency stage. The system is claimed to give easy manipulation, and while the simple direct-coupled aerial tuning is preserved the selectivity is obtained in the tuned anode circuit and the manipulation is much more certain, and easier than with a closed circuit tuner with reaction on the secondary coil. The tuned anode coils are calibrated for all wave lengths, and the instrument thus serves as a wave meter. There is a minimum transference of energy to the aerial when autodyne reception is being employed, and the receiver is extremely silent in working, and is affected to a remarkably small degree by atmospherics.

Description of all the wireless receiving sets which are exhibited would occupy far more space than we can spare. There are cheap sets and sets which are designed on very elaborate lines, and consequently more costly. Among the makers of the elaborate equipments are Messrs. W. H. Sullivan, of Winchester House, E.C. 2, and Burndept, Limited, of Blackheath. The former firm is showing, among other things, a 10–50-watt radio telephone transmitter and a transmitter of the experimental pattern; also microphones and microphone transformers, modulation chokes, smoothing chokes, smoothing condensers, and complete smoothing apparatus. There is a complete four-valve amplifying receiving cabinet, a high-power four-valve amplifier with a range of 150–25,000 m., a six-valve high-power amplifier with a range of 200–25,000 m., a five-valve audio-frequency amplifier, experimental valve amplifying receiver panels, a three-valve note magnifier, a single-valve note magnifier, single-valve receivers, and crystal receivers of various types. The products of Burndept, Limited, of Blackheath, are well known to all experimenters in wireless telephony. By careful attention to details this firm has gained an excellent reputation in the wireless world, and the remarkably good music which is frequently transmitted from the company's experimental station at Blackheath is eagerly looked forward to by a great many who own receiving sets. At the exhibition the firm is not merely showing the exterior of its sets but also the interior, and the exceedingly good arrangement of the wiring and the precautions that are taken to ensure reliable operation can scarcely fail to gain the admiration of all visitors who are familiar with the principles of wireless telephony. The aerial in use at the exhibition was supplied and erected by this firm. Another firm which is showing a good collection of apparatus is Siemens Brothers and Co., Limited. The Siemens broadcasting receiver (type "C V") is enclosed in a polished mahogany box which contains all the apparatus with the exception of the filament battery and telephone headgear. The set has been designed so that it can be used as a crystal receiver, a single-valve receiver, or as a crystal receiver with a note-magnifying valve. The tuning coil supplied with the set covers wave lengths ranging from 350–450 m.

The progress of wireless telephony has led to a considerable demand for high-tension dry batteries and accumulators for the supply of current to the filaments of valves. Siemens Brothers and Co., Limited, are exhibiting a good selection of high-tension batteries, whilst accumulators are shown by the Chloride Electrical Storage Company and the Hart Accumulator Company. The former firm is showing a range of the latest types of batteries for every wireless purpose, a series of low-voltage Exide batteries in celluloid boxes, and various high-voltage sets of Exide batteries. These comprise complete 24, 30, 50, and 60-volt sets in strong and neat wooden trays. Examples of individual high-tension cells are shown in ebonite, glass, and celluloid containers.

Besides the complete receiving and transmitting sets there are many component parts, such as tuners, variable condensers, intervalve transformers and so forth. For accurate and fine tuning the modern multi-layer type of coil has acquired much favour. It is customary to employ a number of coils to cover definite wave lengths, each coil being fitted into plugs which are all of the same size. The duo-lateral or honeycomb type of inductance coils, for which the Igranic Electric Company has the sole manufacturing rights under the De Forest patent, are being shown complete and in the course of manufacture. The advantage of this type of winding is that the self capacity of the coil in comparison with that of concentrically wound coils is very small, which makes sharper tuning possible. Low self-capacity and high-frequency resistance combined with a low absorption factor permit of the transference to the detector of the maximum amount of energy received. When using these coils there are no losses due to dead ends, for the whole of the inductance is used throughout the complete range of wave lengths. Fig. 6 shows one of these inductance coils, whilst Fig. 7 shows a coil holder carrying three coils—primary, secondary and reaction—the centre coil being provided with a selector switch for bringing different tappings into use for increasing the coil's range. The Igranic Company is also exhibiting, among other things, slab inductances which have been designed to meet the demand for a cheaper set of inductances than the honeycomb type. Whilst these coils are not so efficient as the honeycomb type, it has been possible by careful design to reduce the self capacity and absorption factor to a minimum and to maintain the maximum inductance. The Igranic Company has given considerable attention to the design of intervalve transformers, which, as already explained, are used to couple the valves. One of the company's audio-frequency transformers is shown in Fig. 8. Tests are said to have shown that transformer coils wound on the firm's "Lessona" electrical coil-winding machines and treated in accordance with the Igranic process are free from short-circuited turns, and have the lowest possible self capacity. By the use of Igranic intervalve transformer windings a low absorption of energy and good articulation are said to be obtained. There are, of course, also high-frequency intervalve transformers which work without an iron core and various types of these transformers are shown by different firms. In some cases these transformers are of the plug in type and fit into ordinary valve holders. Whereas the low-frequency transformer is suitable for all wave lengths, the high-frequency type has a definite range, and when a wide range of wave lengths has to be covered different transformers are brought into use. On the stand of W. H. Sullivan, however, there are radio-frequency intervalve transformers with tappings connected to a multiple-point switch so that the transformer can be made to cover wave length ranges of 200 m. to 400 m., 400 m. to to 1000 m., 1000 m. to 3000 m., and 3000 m. to 30,000 m. Other firms are also showing radio transformers which are wound to cover wide wave ranges of wave lengths.

The manufacture of wireless sets involves the use of a number of fixed condensers, such as are connected across the telephones, high-tension batteries, &c., and a firm which is showing an excellent collection of condensers of this kind is the Dubilier Condenser Company, Limited. There are four distinct patterns of these condensers. They are all constructed with carefully selected mica dielectric, and are built on the same principles as those adopted for larger power condensers. They are enclosed in moulded insulated cases, and have a very high insulation resistance and very low losses. The condensers shown in Figs 9 and 10 are made in two patterns, one—Fig. 10—having clips for holding a grid leak resistance, whilst the other is merely provided with tag connections to which the leads are soldered. The condenser shown in Fig. 11 is very similar, but it is designed so that it can be mounted on edge in order to economise space on the instrument panel. It is not provided with clips for a grid leak, but merely with metal tags to which connections are soldered. These three types of condensers are supplied with capacities up to .005 microfarad. Various other types of condensers are manufactured by this firm, and also a device which enables the ordinary electric light wiring in a house to be used as an aerial.

Trials of the Motor Ship Eknaren.

In our issue of June 17th, 1921, an account of the sea trials of the single-screw motor ship Yngaren, built by William Doxford and Sons, Limited, was given, and this article was further supplemented by a description of the 3000 indicated horse-power opposed-piston Doxford engine and the arrangement of the main engines and auxiliary machinery on the ship. The Eknaren, which completed her acceptance trial on Thursday last, is the third vessel to be equipped with Doxford machinery, and she is practically a replica of her sister ship the Yngaren, being built for the same owners, the Transatlantic Steamship Company, of Gothenburg. A large party of shipowners, engineers and representatives of shipping interests accepted the invitation of the builders and owners to attend the trial, which, despite hazy weather unfortunately preventing the carrying out of the full-speed and manœuvring trials, was run with every success, the vessel leaving for Gothenburg on the Friday morning. Mr. R. A. Workman, the chairman of the Northumberland Shipbuilding Company, Limited, and a director of Doxford's, presided at the luncheon, and referred to the firm's cordial relationship with the owners and particularly with their representative, Mr. T. Madsen. Mr. Madsen, who had recently returned from a voyage on the Yngaren, paid a high tribute to the economical and satisfactory running of that ship, and felt no anxiety about the success of the Eknaren. Speaking with regard to the ship herself, he said that the price was high, but the owners appreciated that they had got a vessel worth in every way the money spent. He had great confidence in the future of the Doxford opposed-piston type of engine, and felt sure that many similar ships would be built.

Mr. Robert Traill, of the Fairfield Shipbuilding and Engineering Company, Limited, of Glasgow, said that the company of guests had not come to witness a novelty, for the Doxford engine had now been in operation for some considerable time, and the records of the Yngaren and the Dominion Miller had established that type of engine as one of the foremost types of marine Diesel engine built. In the Doxford engine troubles found with other types of engine, chiefly with cylinder covers and the high-pressure compressor, had been overcome; the opposed-piston engine was also a balanced engine. Some engineers had criticised the crank shaft, but he remembered the time when engineers would not look at the ordinary crank shaft as now used in triple-expansion engines. This attitude did not last more than a year or two, and there was no more fear of the Doxford crank shaft than for a crank shaft of the ordinary built-up type. The assembled company would agree that no steam engine that ever put to sea had ever been manœuvred with greater ease than the engine of this ship. The vessel was very light, with the propeller half out of the water, but when the boat pitched there was no racing whatever, as the governor acted instantly. Those present would go home recognising the fact that shipowners must adopt Diesel engines, as the increase in cargo space, the reduced amount of fuel carried, and the smaller crew would so increase the earning capacity that no owner could afford to continue with ordinary steamships. A further consideration was the elimination of the space taken up by boilers and uptakes and the discomfort of the heat, which is often so great in passenger ships, all of which may be avoided by installing Diesel engines. He was able to state that the Fairfield Shipbuilding and Engineering Company, Limited, was now building a 600ft. passenger motor vessel, which would run at a speed of 18 knots and would be engined with internal combustion engines of 12,000 brake horse-power. By adopting this type of engine the passenger accommodation had been increased by 18 per cent., and there was a corresponding increase in the space available for cargo. This vessel would make an eighteen-day trip at 18 knots from Australia to Vancouver, and the advantages were so great that the extra cost of Diesel engines as against steam machinery was of no moment. The Diesel engine was of necessity more expensive than the steam engine, and it was foolish for shipowners to wait, as many did, until the price of a Diesel engine in the ship was the same as the price of a steam engine. This position was untenable, and the advantages were so great that eventually the owners would be bound to consider them. Oil fuel was no longer scarce; it was now found over wide areas and in increasing quantities, which should lead to a lowering of price. Supplies of oil were now available in practically every port in the world. He would remark that in no other vessel he knew of could one talk so comfortably in the engine-room, where everything was so quiet and peaceful. With regard to running costs, the sister ship of this vessel, the Yngaren, was now operating on a fuel consumption of 9 tons of oil per day for the main engines and half a ton of oil for the auxiliary engines and all other purposes. Her speed was 10½ knots, and she recently pulled out of San Francisco loaded 6in. deeper than her water line. Her deadweight capacity was 9300 tons, and with a total fuel oil consumption of 9½ tons per day for 10½ knots, oil being at 29s. per ton, the cost of oil per day worked out at the low figure of £15

Sir Burton Chadwick said that the Eknaren was a splendid vessel, and in the near future this type of ship would put other types out of business. When the saving due to the adoption of the motor ship was considered, it was evident that the shipowner must give this matter careful attention, for it was the most efficient ship that would bring our carrying trade back.

Mr. Robert Doxford announced that the Sun Shipbuilding Company in America was now building under licence from Wm. Doxford two engines to the same specification as that for the engine installed in the present vessel.

The Eknaren is a cargo carrier with limited passenger accommodation, and is without funnel, which gives her a fine appearance which one associates with Scandinavian motor vessels. The leading dimensions of the ship are:—Length, 420ft.; breadth, 54ft.; depth, 25ft.; with 9300 tons deadweight capacity. As we have previously mentioned, her machinery equipment is similar to that of the Yngaren—See THE ENGINEER January 6th, 1922—the main engine being of the four-cylinder opposed-piston Doxford type, designed to develop 3000 indicated horse-power at a low speed of 77 revolutions per minute. During the test bed trials this engine developed an output of 4400 indicated horse-power at 100 revolutions per minute, a figure which gives a significant indication of the rating of the propelling machinery. In the main engines, considerable improvements have been made in the scavenging arrangements and also in the design of the fuel spraying valve. The result of these improvements is that a lower fuel consumption of about 0.40 lb. of fuel per brake horse-power-hour can now be attained, and prolonged tests have shown that the engine will operate quite successfully on boiler fuel oil and oils of the heavy Mexican type. The initiative which marked the installation of the first Doxford engine in a single-screw ship has been fully warranted by the excellent results achieved, and both with regard to silent running and ease of manœuvring the engine undoubtedly occupies a very high place among the various types of marine Diesel engine which are now being built.

CONTRACTS.—The English Electric Company has been successful in obtaining a further contract amounting to £94,900 from the Preston Corporation, for the erection of the new super-generating station to be known as the Ribble Power Station. The company is also supplying the large turbo-generating sets and condensers, &c., for this station.

Railway Matters.

The 1.30 p.m. West Coast express from Glasgow Central to Euston—long known as the "up corridor"—is now due at Euston at 10 p.m., instead of 10.30. This is a great improvement, as the pre-war time for the run was 8 h. 45 min.

A third death has occurred as a result of the collision on August 21st between two workmen's trains at Milton Range halt, between Gravesend (Central) and Hoo Junction on the South-Eastern and Chatham line to Strood and Maidstone.

The principal railway companies in the North have arranged contracts for locomotive coal for the three months ended December 31st on the basis of 20s. per ton at the pit for best South Yorkshire hards and 19s. per ton for Derbyshire and Notts. hards.

The single line belonging to the Great Western and Midland Joint Committee between Sneyd Park Junction and the Hotwells terminus, Clifton, has been closed. It was purchased by the Bristol Corporation and is being absorbed by the new road between Bristol and Avonmouth.

As there was only a difference of 1 per cent. in the cost of living on September 1st as compared with June 1st—79 per cent. over July, 1914, as against 80 per cent.—the Central Wages Board has decided that no further change shall be made in railwaymen's wages. The next review is in December.

It is intended shortly to invite tenders for the new line of the Metropolitan and Great Central Joint Committee from Rickmansworth to Watford. The electrification of the Metropolitan will then be extended northwards from Harrow and a service of fast trains will run to and from the City *vid* Baker-street, in competition with the London and North-Western from Broad-street.

The recent statement by the Ministry of Transport that it has no authority to hold formal inquiries into road accidents reminds us that until 1871 the Board of Trade was in the same position as to railway accidents. The latter, under the Act of 1842, had to be reported by the companies and the Board held inquiries into such as its officers thought fit, but the inquiries were not legally established until 1871.

The death was recently announced, at the advanced age of 85 years, of Mr. A. L. Stride, who was the chairman of the London, Tilbury and Southend Railway until it was taken over by the Midland Railway in 1912. Mr. Stride was trained as a railway engineer, and his first connection with the Tilbury Railway occurred in 1875 when he went from the London, Chatham and Dover to be the engineer and manager of the former railway.

The beginning of work on the Underground extension from Golder's Green to Hendon has now been followed by the letting of the contract for the new line, 3.05 miles in length, that will carry the Golder's Green Railway to Edgware. The route and the conveniences these extensions will provide were explained on page 661 of The Engineer of June 16th last. The successful contractors are the Foundation Company, Limited, Windsor House, Kingsway, whose tender was £258,468, and it is hoped to complete the work by the end of 1923.

The Mining Association of Great Britain has requested the Railway Clearing House to arrange a further meeting to discuss lower rail rates for coal traffic. It points out that the coal industry itself, with a loss of nearly £2,000,000 in the fifteen months since Government control came to an end, has done everything in its power to restore itself to an economic basis. Miners' wages have declined to a point between 40 and 50 per cent. above the 1914 figure, while gross trading profits—even in July last, while America was buying large quantities of British coal—were less than ½d. per ton. The Association is strongly of opinion that present conditions do not warrant a railway charge of more than 50 per cent. above pre-war rates for coal traffic.

In an article in the *Manchester Guardian* Commercial Reconstruction in Europe issue, Mr. R. L. Wedgwood, the general manager of the North-Eastern Railway, discusses the Railways Act, 1921. In his view, the question, "What saving will be made by grouping?" is both unanswerable and unimportant. Unanswerable because the only savings that really count must be spread over years, and cannot by any ingenuity be isolated; unimportant, because "savings" to be permanent can only flow from a sound basic organisation, and are entirely dependent upon the establishment of the industry in a satisfactory relation to the trading public, on the one hand, and to its employees on the other. These relations are fundamental, and if they are neglected "savings" realised in one year will be wasted in useless friction in the next, or swallowed up in the loss due to the progressive discrediting of the industry.

It will be remembered that the Committee presided over by Sir William Acworth was appointed because the contract of the East Indian Railway Company with the Government of India expires in December, 1924, and that of the Great Indian Peninsula Railway Company in July, 1925. The question has again arisen what the future system of management shall be. The Acworth Committee considered four possible methods, but unanimously rejected the first two—(1) management by English companies and (2) management by a combination of English and Indian companies—and was equally divided on the question whether the management should be in the hands of Indian companies or be under the direct control of the State. The Bengal Chamber of Commerce, whose views were invited, reports that it has emphatically opposed direct State management, especially in the case of the East Indian Railway. It also rejected a suggestion that, in the event of State management being adopted, it might be possible to associate, with the agent, a board of directors on the lines of port trust management, and examined in detail two alternative draft schemes which have been suggested as perhaps suitable in the event of company management being decided on. It was agreed that, in that event, the company must be domiciled in India. There seems, says the Chamber's report, to be no future, therefore, for purely English companies.

Notes and Memoranda.

A building material, which is said to be superior to concrete as regards resistance to heat and damp, is being made in Silesia by cutting strips of turf, arranging them in a wooden framework and solidifying them with cement and chalk.

Writing to the editor of *Kahncrete Engineering*, a correspondent says that two steel chimneys in Glasgow which were lined with 1½in. of cement mortar on Hy-Rib reinforcement were recently inspected after eighteen months' service, during which the temperature of the stack was constantly 400 deg. Fah., and practically no damage to the lining was discovered. The chief advantage of the lining is, of course, its thinness and light weight as compared with brick lining.

A new method of tamping is being tried at the Luipaardsvlei Estate mine. The tamping material is constructed of porcelain, and is inserted in the hole in the form of a wedge. There is a hole in the porcelain through which the fuse passes. The idea of the device is of course to minimise blow-backs and to secure greater burden of rock. So far it can only be said that the device has given promising results, and the progress of further experiments will be watched with interest.

According to Mr. H. W. Wagner, writing in the *Iron Trade Review* on the grinding of steels, investigation showed that annealed stainless steel, under constant feed, developed the highest grinding resistance of any metal tested. Wheel wear, when rough grinding it, was excessively high and the wear continued high even with hard wheels because the clearance between grains was insufficient and loading increased. Hardened stainless steel also caused considerable wear when fairly heavy feeds were taken. Also, if light cuts are employed, as for finished grinding of a flat surface, the hardened stainless steel has a tendency to burn.

An account is given in the *Electrical Review* of some experiments carried out in the Baggeridge colliery, South Staffs., on wireless telephonic communication between the workings at a depth of 700 yards and the bank. It was found that Morse signalling was more reliable than telephony, but "notwithstanding this, the experiments were of a very successful nature, and prove that an interesting field for research awaits the radio-scientist and the mining engineer. The day may come when wireless sets will be as common in mines as they are on ships, performing service just as useful, particularly when disaster befalls those who work far below the surface of the earth."

The production in this country of a chemical porcelain body considerably superior to any of the heat-resistance porcelains that have hitherto been made in any part of the world was foreshadowed recently by Dr. G. White, of Worcester, at a meeting of the Ceramic Society at Stoke-on-Trent. The main feature of the method is, according to the *Chemical Trade Journal*, the bringing of the process of devitrification to practical completion during the actual manufacture. The tendency to devitrify possessed by all super-cooled fluids is always a factor favouring fracture, so that the complete removal of this tendency should lead theoretically to a considerable improvement in the stress-resisting power of the porcelain.

Discussing the unnecessary massiveness of electric tramcars, the *Electrical Times* says "the British double-decker is a perpetual object of wonder. If you are one of the few people inside on a sunny day you may watch the plate glass of the windows sliding fore and aft as the framework bends and lurches. How the glass withstands this fierce ill-usage test, how the great crowd on top are whisked round sharp curves without disaster, why the whole groaning and rocking structure never collapses, these are eternal mysteries for us. But for that matter neither the British nor any other tramcar is exactly fascinating as the engineer's attainment at the zenith of his genius. It began under equine auspices, and horsey influence has not always been the best. We wonder if tramcars have yet risen to all the possibilities of the electric drive? Shall we burn them all and start afresh?"

The recent researches of Bridgman have shown that under hydrostatic pressure the resistivity of steels decreases, while the earlier work of Tomlinson on stretched steel wires showed that under tension less than the elastic limit the resistivity increased. According to a recent issue of the Science Reports of Sendai University, Mr. Sin-iti Fukuta has, under the direction of Professor Honda, carried the observation of the effect of tension on resistivity beyond the elastic limit, and has succeeded in showing that up to stresses of the order of 5000 kilos. per square centimetre, steels with various carbon contents increase in resistivity 1.14 by 10^{-5} per cent. per kilogramme per square centimetre of tensile stress, the proportionality continuing past the shoulder of the stress-strain curve. In all cases about 90 per cent. of the observed change of resistance of the specimen was due to its elongation and cross contraction.

According to the *Building News*, paints which may be diluted with water for use comprise a pigment, a medium such as a drying oil or a solution of resin, water, and a stabilising agent soluble in water and in the medium. The stabilising agent may be a volatile substance such as alcohol, pyridin, acetone, or naphthenic acid, with or without an admixture of a less volatile agent such as glycerine or Turkey red oil, or it may be an ammonia or alkali soap of a resinous acid or of a drying fatty acid. When alkali soaps are used as stabilising agents, an oxidisable non-metallic element such as sulphur, phosphorus, or selenium is added, thereby producing acids which act on the soaps and produce insoluble compounds. The fatty acids set free from the soap by this reaction may themselves function as the binding medium. Oils partly hydrolised by means of enzymes such as are found in castor oil seeds may be used as media, the free glycerine present acting as stabilising agent. The ingredients may be initially mixed without water, and the stabilising agent may also be omitted and dissolved instead in the water used for dilution. Suitable binding agents are linseed oil, hemp seed oil, poppy oil, walnut oil, and wood oil. The process is said to be patented in England.

Miscellanea.

Forty-five tenders have been received for installing moving platforms in the Paris Underground stations, including tenders from Great Britain, the United States and Belgium.

A report from Moscow says that the Soviet Government has assigned the sum of 30,000,000 gold roubles for the reconstruction of the mercantile marine. The direction of the work is said to have been entrusted to German engineers.

Information has been received by the Board of Trade that an International Exhibition of Patents and Inventions is to be held in New York during the week commencing January 8th, 1923. Full particulars as to the cost of space and plans of space available are expected shortly in the Exhibitions and Fairs Division of the Department of Overseas Trade.

The production of pig iron in the southern district of Russia during the first half of last year was 2,307,000 poods, as compared with 416,000,000 poods in the same half of 1921. The other pig iron producing districts also show increases. The production of Martin steel in the southern district was 3,890,000 poods, against 1,029,000; and the production of rolled iron and steel 3,218,000 poods, against 1,030,000 poods.

The Beighton Gas Company, South Yorkshire, has abolished the use of its gas-producing plant, and is meeting all the demands of its consumers with purified coke-oven gas from the coke-oven plants at the Beighton and Waleswood collieries. Hitherto the collieries have made no use of the gas, which has been allowed to escape. The gas is conveyed from the coke ovens through special mains which have been laid down.

The Paugan Falls of the Gatineau River, Canada, are to be the scene of hydro-electric development on a large scale. A dam will be constructed which will create a reservoir 10 square miles in area. The ultimate development contemplated is 150,000 horse-power, and the cost is estimated at 10 million dollars. The falls are situated 35 miles from Ottawa, which is at present dependent upon the Chaudière Falls for the 50,000 horse-power of electric energy employed.

The Municipality of Penang, Straits Settlements, is negotiating for the construction of a large power station on the Prai wharves, from which Penang will be supplied by means of submarine cables. The station has been designed for an ultimate capacity of 135,000 horse-power, and will be capable of dealing with the whole of Penang, Province Wellesley, and possibly parts of Kedah. There will be electric cranes, &c., at the Prai wharves, and the tramway system is being converted for railless electric cars.

Work is proceeding upon the installation of a new power plant for the use of the Quito Electric Light and Power Company (Ecuador). The plant is situated in the Chillo Valley, and will develop 3000 horse-power, but the falls utilised are capable of developing a total of 6000 horse-power. When the installation has been completed, and this is expected to be about November next, the Government will probably find it desirable to use the electric power provided to operate the Quito-Ibarrá railroad, as the supply available is ample for the purpose.

It has been proposed that an Institute of Paint and Varnish Technologists shall be founded, and a dinner is to be held shortly to inaugurate the new Institute. The objects of the Institute will be the dissemination of practical and scientific knowledge by reading and discussing papers, the improvement of technical education, the promotion of research, and the establishment of close relations with the Government and with societies interested in the products of the industry and their application. Applications to attend the inaugural dinner should be forwarded to Mr. H. D. Bradford, 42, Ribbledale-road, S.W. 16.

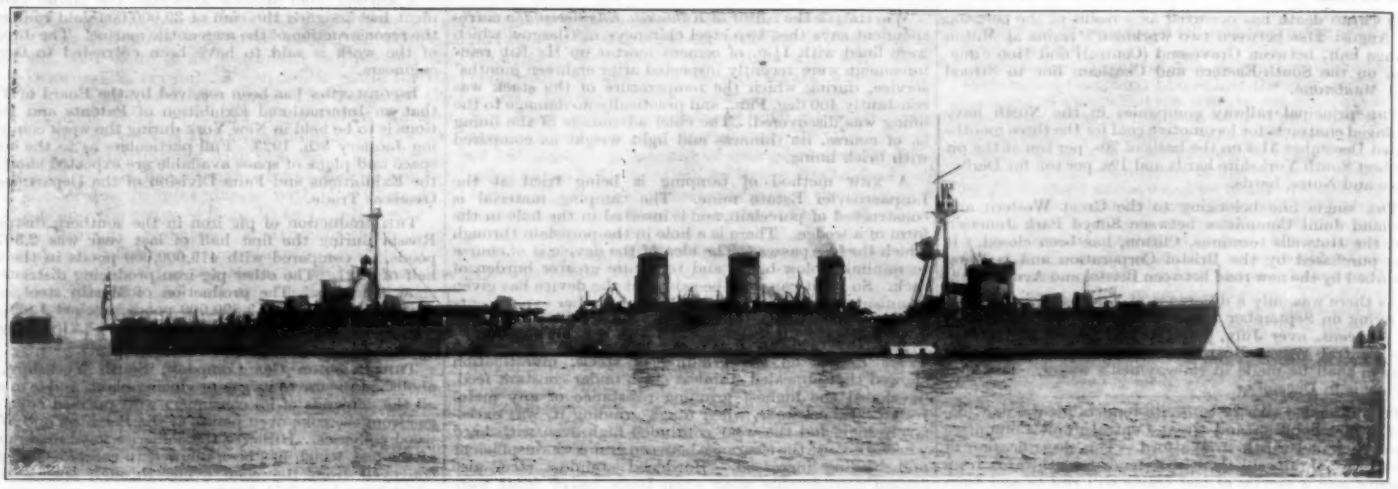
The reservoir which supplies Colombo with water has a capacity of 1200 million gallons, and is formed by an earthen dam about 400ft. long and holding up a maximum depth of 60ft. of water. The dam slopes approximate 2½ to 1 in the rear and 3 to 1 in front. The top width is 16ft. exclusive of the parapet. It is now proposed to increase the storage by 500 million gallons by means of an additional 10ft. depth of water, which will involve raising the new weir to 370ft. above sea level. The dam is now about forty years old, all the settlement that is possible has, according to *Indian Engineering*, taken place, and revetment is well consolidated. The cost is estimated at about Rs. 3½ lakhs.

The motor yacht Ara, owned by Mr. W. K. Vanderbilt, which is claimed to be the largest yacht of the kind in the world and is now being completed for sea by Camper and Nicholson, of Southampton, was fumigated by Siebe, Gorman and Co., Limited, on Sunday, September 17th, with hydro-cyanic gas (HCN), in accordance with the United States Government regulations. The whole of the fumigation was completed within seven hours from the time of firing the charges until the ship was certified by the port sanitary authorities as clear of poison gas. It is said that, considering the number of compartments, &c., that had to be cleared of gas in this case, the short time taken to complete the work constitutes a record.

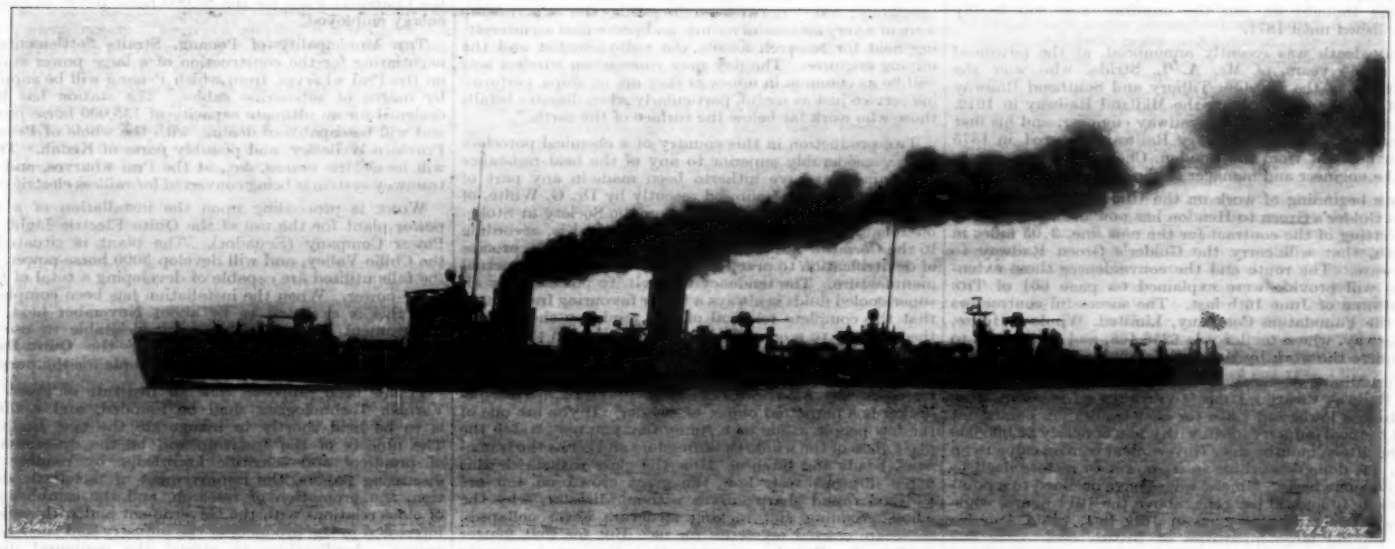
In the Canadian notes of the *Iron and Coal Trades' Review* there is a reference to the proposal to organise a large iron and steel industry in British Columbia. It is said that the Government favours a plant with a capacity of 400 tons a day of pig iron. Those interested in the company were told (1) that the Government would be prepared to submit legislation making the iron ore bodies of the province available for use either on a percentage, tonnage or royalty basis; (2) that the present legislation providing for a bounty on pig iron produced in British Columbia would be repealed; (3) that the Government would promote legislation authorising a guarantee of the company's bonds to the extent of one-third of the amount required to establish an iron-smelting plant. This guarantee would be conditional upon the Dominion Government and the Imperial Trade Facilities Committee guaranteeing the other two-thirds of the capital required.

SOME NEW JAPANESE WARSHIPS

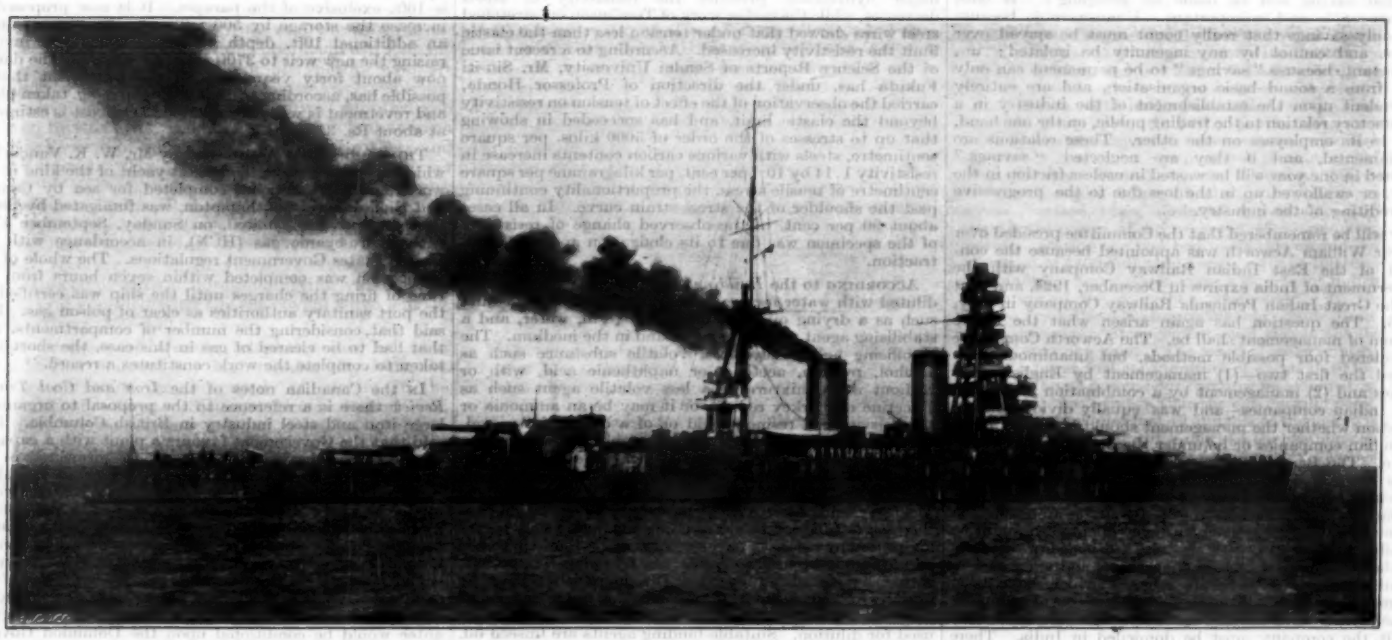
(*For description see page 344*)



THE LIGHT CRUISER OH-I



THE DESTROYER HAKAZE



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THE ENGINEER.

OCTOBER 6, 1922.

Payment by Results.

By how much could the output of our engineering factories be increased if there were no restrictions of any kind; if every employer were allowed, without let or hindrance from trades unions, to introduce the best machinery and to use it to the best advantage; if every workman were allowed to do the very best he could do without detriment to his health? By how much more, in such circumstances, would the lot of the workpeople be improved by increased earnings, and the lot of the purchaser be bettered by decreased costs? By how much more would the welfare, the trade, the contentment of the country be magnified? How much more readily could we face foreign competition, decrease unemployment, and effect those social reforms that are delayed in their coming by the misdirected efforts to produce them? On the answers to such questions as these economists are not agreed, but all, at least, are in no doubt that under conditions of complete independence the rate of production could be increased by a very large amount; experienced employers have placed the figure, for labour alone, at 50 per cent. on a conservative basis. Labour, and those economists who share its views, do not challenge the figures. It is the deductions from them that they oppose. They deny that the workmen would continue to receive better pay, that unemployment would be reduced, that purchasing costs would be diminished and that trade would be encouraged. For the same malady the employers on the one hand and the labour leaders on the other propose diametrically opposed remedies.

A few months ago we suggested that, with a view to discovering and laying before the public the influence of trades union restrictions on output, a Commission should be appointed by Parliament to take evidence and examine the whole matter critically. That Commission may yet come into being, and if it does, the report compiled after two years' labour by a joint committee of the Engineering and National Employers' Federation, the Shipbuilding Employers' Federation, and the Trade Unions' Negotiating Committee will provide it with a jumping-off place. The report, which we are fortunately in a position to deal with at length, is as conclusive a document on one point as the heart of the industrial reformer could expect. There are no facts in it which have not been known for many years past by employers and employed. Over twenty years ago we showed in a series of articles on the Premium System—which subsequently passed through many editions in book form—that outputs could be readily increased by large amounts if men were offered a proper inducement and were *permitted by their unions* to accept them. Sir William Rowan Thomson has shown that 66 per cent. of the men in a machine shop, in 1913, increased their output by over 40 per cent. and that 19 per cent. of the men increased it by over 50 per cent. Many other observers came to the same conclusion long ago, and it was very largely because of the known existence of this reserve of power that the eight hours' day was agreed to with relatively little opposition. It was held, on evidence that has since proved illusory, that as much would be produced in the short day as in the long day. As a matter of fact, there is little or no doubt that the reduction in output is exactly equivalent to the reduction in time. With this experience before their eyes, when a further shortening of the week, from forty-seven hours to forty-four hours, was demanded in 1919, the employers set up a strong opposition, and eventually the application was withdrawn, and a joint committee was appointed to investigate "the economic relation of production to hours of work, and in this connection, the methods of manufacture in the shipbuilding and engineering industries in this and other countries." Under this very elastic reference the Committee, composed, it must be remembered, of labour representatives as well as employers, entered upon an inquiry by *questionnaires* and visits, which swept not only Great Britain, but Belgium, Germany and Holland, and would have been extended to America had the industrial conditions in that country made it desirable. It is to be noticed, too, that we have figures related to what may be regarded as a normal datum year, 1913, as well as to post-war years during the height of the trade boom and the trough of the trade slump. It is unnecessary to repeat here the figures which appear in the section of the report which we reprint this week, but we may direct attention to the tabular statement which shows the effect of payment by results on rate of output in a shipyard. It can be safely be said that in shipyard work the time occupied on nearly any given job can be reduced by at least one half; in other words, that output can be doubled! But shipyards are crying examples, and it is at least satisfactory to know that such offences as working short time are but little known in mechanical engineering shops. It would be wrong to jump to the conclusion, from the figures published in the daily Press last week, that the extremely bad conditions shown prevail throughout all the engineering industries of the country. Far from it. A close examination of the report shows that as a whole nothing like the restriction of work that prevails in shipyards is found in other works. On the other hand, there is abundant evidence that were payment by results the general practice, and were the workpeople not hindered by false principles, output all round could be easily increased by something between 30 and 50 per cent.

It was not to be expected that a joint committee of the kind that prepared this report would offer any critical remarks. That would have been too delicate a matter for it to deal with; it must be left to other hands. There is also some evidence—shall we say of careful editing or of a reluctance on the part of some employers to give unpleasant economic facts? Hence, whilst the report takes us a long way and helps us to see fairly clearly the effects of the labour policy of restriction, it leaves us in the dark as to what could be attained if men with long vision could organise and manage workshops free from labour restrictions, and if all workmen were allowed to work on a payment by result basis. It does not, therefore, answer the questions we advanced in our first paragraph. What it does do, and that is important enough for a start, is to make it clear, to all who read, that whenever we choose as a nation to insist upon payment by results as the standard method, then, and not till then, shall we obtain from labour the output that—without strain—it is able to give, and that then and not till then, labour will be able to enjoy the rate of wages to which it aspires.

Corrosion.

Among the problems with which engineers and metallurgists are confronted at the present time, there is none of greater and more pressing importance than that of corrosion. This importance follows from the ever-widening use of metals, both ferrous and non-ferrous, not only in engineering proper, but in all the daily uses of civilised life. In engineering structures alone, the equivalent of millions of tons are literally destroyed every year, as Sir Robert Hadfield has recently pointed out, and the loss represents an amount of money and labour which mankind can ill afford. The mere

fact that metals tend to corrode and to revert to something like the condition of oxidation in which we generally find them in nature, is in itself by no means surprising. We live in a strongly oxidising atmosphere; indeed, conditions which are, obviously, inimical to the prolonged existence of metals in the free state are essential to human life. The more or less rapid destruction of metals by the processes of oxidation, which may be complicated by other chemical processes, is therefore perfectly natural and normal. In the case of some metals, such as aluminium, for instance, it is almost an anomaly that they should be capable of prolonged existence in our atmosphere at all, and—as is well known—they owe their power of resisting rapid oxidation to the formation of a strong and continuous protective coating, which more or less stops the oxidising process.

In view of the enormous importance of corrosion from every practical point of view, it is a matter for congratulation that after years of neglect considerable attention is at length being given to it by researchers, and fortunately they receive the necessary support, partly from such bodies as the Institution of Civil Engineers and the Institute of Metals, and partly from the Government Department of Scientific and Industrial Research. As a result, important advances in our knowledge of the nature and mechanism of corrosion have been made, notably by Dr. Newton Friend and Dr. G. Bengough. The latest report published by the latter—the sixth report to the Corrosion Research Committee of the Institute of Metals, presented at the recent Swansea meeting, and dealt with in our issue of September 22nd—is of special interest. When it is realised, as indicated above, that for most metals the occurrence of oxidation is a normal and almost necessary process, it is the study of inhibiting causes that becomes of primary interest. Such causes have been sought in two directions. For a very long time, the so-called "electrolytic" theory of corrosion was widely accepted, and differences of electric potential, either internal and local or external and general, were looked for to account for all cases of rapid corrosion. No doubt in many cases such forces are at work, and the efforts made to eliminate them have proved successful to a limited extent. Thus the effort to reduce internal sources of electrolytic action by the use of metals of very great purity have met with only slight success; on the other hand, the application of external electric currents having a protective action has, in some cases, proved extremely effective. The actual application of such currents, however, is a difficult matter, and some of the most difficult cases of corrosion have not yielded to this type of treatment. More recently, the view that protection is to be sought by a study of the products of corrosion with a view to rendering them protective, in the same way as the oxide skin tends to protect aluminium, shows promise of greater fruitfulness. Although not, perhaps, evolved from any such considerations by its discoverers, it is held by some that the formation of a kind of protective coating or "passive" skin is the real secret of the non-corrodibility of the "stainless" or non-rusting steels containing chromium. In the great majority of cases, on the other hand, it is coming to be understood, thanks to the work of Bengough, that intense local corrosion may result from the accumulation of corrosion products which are not only non-protective, but actually accelerate corrosion. To find the explanation of many of these actions, appeal is now being made to the very modern science of the chemistry of colloids. To most of us, colloidal chemistry is suggestive of organic materials like glue and gelatine, but in recent years a colloidal chemistry of metals has also been developed. It is quite probable that the enthusiastic workers in that field may endeavour to carry their applications of this branch of chemistry too far; but Dr. Bengough—following, we believe, the lead of Dr. Newton Friend—has clearly shown that colloidal solutions—"gels" and "sols"—play an important part in many of the phenomena of corrosion. Nor is this surprising, when we realise that many of the products of corrosion, such as the metallic hydroxides which result from the oxidation of metals in the presence of water, are often met with in a highly gelatinous form. On corroded parts a "slimy mess" is at least as often to be found as a hard crystalline deposit, and it is—roughly speaking—with the understanding of these "slimy messes" that colloidal chemistry has to deal. Whether or not, therefore, the colloidal theory of corrosion affords the full and final explanation of the phenomena, there can be no doubt that the metallurgist, and indirectly the engineer, will be forced to take greater cognisance than hitherto of the chemistry of colloids.

Men of the older school, particularly when faced with such an array of highly specialised jargon as that adopted by colloid chemists, may be pardoned if they face the new view-point with some hesitation. The electro-chemical theory of corrosion was so easily understandable that if we must abandon it we shall do so with regret. Yet the history of scientific progress in connection with our knowledge of metals themselves must warn us not to "shy" unduly at a new array of scientific nomenclature. Not thirty years ago the infant science of metallography was widely ridiculed because of the list of "-ites"—"ferrite," "pearlite," &c.—with which its literature was adorned. To-day the scoffer is silent, and these terms are familiar to all metallurgists and even to some engineers. We must therefore face the intrusion of colloidal chemistry into metallurgy and engineering with an open mind, ready to learn and appreciate what it can teach us. These technical words employed by the chemist are, after all, merely convenient abbreviations or symbols; when the concepts behind them are understood, the terminology becomes not only a minor matter, but an easy one.

Speeding-up on the Underground.

It is safe to claim that in automatic and power signalling we now have nothing to learn from America; in other words, that our installations are as complete in detail and as perfect in operation as any to be found in the United States. Further, that when it comes to handling rapid-transit trains we have a definite superiority. The improvements brought into the Underground services on Monday last have led us to make these statements, as it is mainly by automatic signalling that they have been made possible. An advantage of this method of signalling is that the signals can be placed in any position, so long as they are outside the braking distance of the train they protect. What are known as the sections, *i.e.*, the lengths of line protected by each signal, are determined by certain factors, in which are speed and braking distance, and the sections are so arranged that the trains should always be on the move, at normal speeds, except when approaching, stopping at or leaving a station. These station stops have to enter into the calculations, and provision is made, in fixing the position of the signals, that trains following those standing in stations are always on the move at the same speed as they would be running at were there no train in advance of them. Approaching stations, where the speed gets lower, the signals are nearer together, so that by there being two or more signals in the rear of a station trains can come quite close up to that station whilst it is already occupied by another train. It is by the rearrangement of the sections and signals that a greater number of trains has been made possible. Where the Underground system is at a disadvantage, compared with the New York Subway, is that the latter has express and local lines. Trains on the former stop only at the more important stations, and leave the local trains to deal with the intermediate stations. Our nearest approach to this is the non-stop train. On the District, going west, trains stop at all stations up to and including Sloane-square—the station in the rear of South Kensington—whence, east of the latter station, the Inner Circle trains branch off. Say there is a minute-and-a-half headway between a Wimbledon train, an Inner Circle and an Ealing train; there would, west of South Kensington, be three minutes' interval between the Wimbledon and the Ealing trains. The Ealing train, with this extra minute and a-half, can thus miss South Kensington and Gloucester-road stations, and not be delayed entering Earl's Court by the Wimbledon train. Earl's Court has two down lines, which extend, in the Wimbledon direction, up to outside West Brompton Station, and at Putney Bridge Station there is a bay line. These provisions allow a non-stop train to Wimbledon, missing three stations, to be sandwiched between two Earl's Court–Putney Bridge local trains. West of Earl's Court, trains for Ealing, Hounslow and Richmond follow each other, the last going off at Turnham Green, whilst the Hounslow train branches off at Acton Town. Each diversion increases the time from the passing of the preceding train and gives greater freedom for the acceleration of following trains, the slower trains occupying that amount of extra time that the non-stop gains.

Chinese Engineering Notes.

(From our own Correspondents.)

Peking.

Tenders are being invited by the Peking Syndicate, Limited, managers and administrators of the Tao-Ching Railway, for sundry supplies in connection with the extension of that railway to Menghsien, a town on the north bank of the Yellow River. The articles required include telegraph poles, motor trolley, picks, shovels, hand pumps, nails, rail saws, &c. &c. In the near future tenders will be invited for some 3000 tons of rails (85 lb. section), sleepers, spikes, &c.

Negotiations are proceeding in this city between the representative of the Stinnes group and some Chinese financiers for the formation of a Sino-German Industrial Bank. The Germans more than anyone else realise the value of active co-operation with the Chinese, particularly in financial matters, and it is intended that this bank shall be the financial medium for all German enterprises in this country. The Germans in China naturally suffer from the present value of the mark, and one of the objects, if not the principal one, of this new bank is to avoid the necessity of bringing German money into this country at the present rate of exchange. The Bank, once formed, can raise all the additional capital it requires, in China, either by raising loans or in the form of debentures. The Chinese have plenty of money to invest, and where there is an opportunity of investing it in a Sino-foreign bank, where it obtains full protection, they will always take advantage of the position. To get business in China a system of deferred payments is invariably necessary, and the Germans will be able to do this through this Bank.

The first of the six steamers belonging to the Stinnes Line, the ss. Emil Kirdoff, is due in Shanghai in November next, and whilst it is understood that for the time being the freight rates will be the same as on the other lines, it is believed that passenger rates will be cut considerably. It is understood that the Siemens China Company (German) is negotiating with the provincial authorities in Honan for the installation of a long-distance telephone system, and that the representative of that company is discussing details with the Military Governor, General Feng Yu Hsiang, known as the Christian General.

A group of Germans, believed to be connected with the Stinnes group, has recently secured a valuable coal-mining concession in the Province of Shansi. The area of the concession is about 15 square miles, and it is believed that the coal is equal in quality to any found in China. The concession is in the vicinity of Fengchow and the concessionnaires have the right to construct a light railway to the Yellow River on the western border of the province. The coal will then be transported by water to the many markets existing along the river. The approximate financial returns for the Chinese Government railways for the year 1921 show alarming decreases in revenue. In the year 1920 there was a total surplus from all railways of about 40,000,000 dols., whilst in 1921 the surplus was only 23,000,000 dols. The gross receipts of the Peking-Mukden Railway amounted to over 25,000,000 dols., whilst the gross returns of the Peking-Hankow line amounted to 24,000,000 dols.

Shanghai.

The remark constantly made in print and verbally that a greater yield could be obtained if development schemes were instituted, is a platitude, but it is the very opposite when applied to the produce of China, and with American and European industries starving for raw materials and willing labour, the condition of affairs in China *vis-à-vis* the world becomes anomalous. The observer travelling only the beaten tracks in this huge country cannot but be struck by the wonderful fertility and productiveness of the land, and the man with constructive ideas places in his mind's eye flour mills here, cotton mills there, and so on as he passes and wonders that he travels sometimes for days without the sign of a chimney. However, he finds these belching pinnacles of trade when he lands in a foreign concession, and also finds that most of them are native-owned, which shows that we foreigners are doing a lot for China without really adequate return. In other words, it becomes apparent that the Chinese are using us and the facilities we provide and have paid for to make money for themselves. The growth of engineering proclivities in this country, as evidenced by the increasing number of foreign-educated Chinese engineers, is tending to induce the Chinese to think and plan on more practical lines, and as many of these engineers get drafted into Government offices their effect is beginning to tell on the policy of the country, and they, at any rate, appreciate the value of work and efficiency, and when their practical minds overcome the inherent obsession of the average Chinese mind to delight in besting the foreigner, there is a hope that a new era of sound trade may dawn.

The conference going on in Shantung between the Chinese and Japanese delegates over the retrocession of that province to China is a danger to Occidentals, as giving the Chinese the impression that they are quite able to adjust matters between Orientals, but is

inevitable, and it is to be hoped that the resulting settlement of differences will not be used to militate against the well-intentioned efforts of foreigners to help this country; but perhaps Japan will be unselfish and realise the importance of international reciprocity.

A sugar factory with a capital (entirely native) of about £3,000,000 is to be started at Woosung, the port, about 12 miles distant from Shanghai, at the junction of the Whangpoo and the Yangtsze Rivers. The machinery for this factory has been ordered from America and Germany, and the construction of buildings will be begun within the next few months. This is an interesting development from several points of view as being an entirely native enterprise, manufacturing from a raw product grown in China, though not in these latitudes; and also interesting as showing that the Shanghai Settlements are becoming too expensive as to land, and that Woosung has an opportunity of becoming important. Woosung wharves—there are only two at present—are rail-connected to the trunk railways running to Nanking on the north of Shanghai and Hangchow to the south. There are 30ft. of water alongside the wharf line against 21ft. at Shanghai, and the port is nearer the sea by 12 miles than is Shanghai. The port of Woosung should be a suburb of Shanghai, but being entirely under native administration, is in danger of being starved for capital for development purposes and administrated rather in opposition to Shanghai interests. In order to avoid any antagonism between the interests of Shanghai and those of Woosung owing to lack of combination between the foreign control of Shanghai and the native control of Woosung, it is very important that Shanghai should invest in Woosung, and that can only be brought about by an appreciation of the situation by the home influences, as the local vested interests of Shanghai will be averse to any expansion of port facilities until land values in Shanghai cease to accrete in value as quickly as they have done within recent years.

A more far-sighted policy with regard to the expansion of Shanghai could be inaugurated by London financiers investing in property and development work at Woosung, and eventually linking their investment with existing interests in Shanghai, and unless this be done, the Chinese will have some reason to suspect the Consortium or whatever financial combination be formed to assist Chinese development schemes; of selfishness should foreign money be only allotted to districts which in their development could not affect existing foreign interests. In other words, it will be necessary that any development work which foreign money supports shall be made regardless of any particular interest, but only have the general benefit of this country in view, and that will be a little difficult because the Chinese have for a century bottled up foreigners to expand and spread their profits for the good of native interests.

International jealousy always stands in the way of a beneficial direction of development so that the sooner the Consortium agrees on a financing policy for China without prejudice to Chinese patriotic feelings the better it will be for individual national interests. As it is now, foreigners are decrying each other to the Chinese and, generally speaking, making fools of each other to the amusement of the Chinese and to the detriment of a constructive policy. It should be realised that if we are going to stay with China we must act unselfishly in her interests. There are many orders for machinery waiting to be placed, but the placing of them awaits a greater stability in the country. That assurance of stability is being demanded by foreign merchants, and no doubt rightly; but when it is realised that it can only be attained by unselfish foreign help it is obvious that unless something is done soon to stop the present trouble, the situation will reach an *impasse* and the invaluable trade of China wilt into a lost cause.

British Association.

No. IV.*

SECTION B.

THE NITROGEN INDUSTRY.

AN entire session of the meetings of Section B at Hull was devoted to a discussion of the present position in regard to the fixation of nitrogen.

Dr. J. A. Harker, dealing with post-war progress in the manufacture of nitrogen, said that he deemed it his duty to utter a warning as to the policy of Germany in this respect. Notwithstanding the statement that Germany was unable to pay her war debts or to fulfil the obligations imposed upon her by the terms of peace, it was notorious that large sums of money had been found for the restoration and development of German plants for the fixation of nitrogen. In the year 1913 the consumption of fixed nitrogen in Germany was only 200,000 tons, of which one-half was imported, whereas in May last the manufacturing capacity of Germany had been raised to nearly 300,000 tons per annum, and it was stated that by the end of the year the rate would reach 500,000 tons per annum. That meant that Germany was pursuing a policy by which enough fixed nitrogen for an enormous output of explosives could be produced as well as of fertilisers to render the country self-supporting for supplies of food by a system of intensive cultivation. He did not wish to be an alarmist, but there was danger lest civilisation should again be caught napping. It was a fact that those who in this country had to make important decisions during the war were more ignorant than most schoolboys on the fundamental chemical questions involved. It was too much to hope that politicians to-day were much better informed.

Dealing with the existing processes for the fixation of nitrogen, Dr. Harker pointed out that the arc process, which was due to the pioneer work of the late Lord Rayleigh, although satisfactory from the engineering process, was, regarded from the chemical aspect, a poor process, as only 2 per cent. of the electrical energy was transformed into chemical energy. Other methods of higher efficiency held out more promise. There were at least eight synthetic processes now in operation. A very large plant on the cyanamide system had been put up in Alabama during the war period, but it was doubtful whether it would remain in operation. The output of synthetic ammonia by the process was over 200,000 tons a year, and an American company was combining the production with phosphates to make a valuable artificial manure. The cyanide process, which was the oldest of all, had the disadvantage of high cost of operation, and further research was required.

The Häusser process of nitrogen fixation was discussed by Mr. C. J. Goodwin. He said that the commercial success of the manufacture of synthetic ammonia in conjunction with the Ostwald process of obtaining nitric oxide and nitric acid by combustion of the ammonia, had created the impression that in the near future synthetic ammonia would be the principal raw materal for nitric acid manufacture. That view was strengthened by the economic failure of the arc process except under very favourable conditions and by the price restrictions in the nitrate of soda and sulphuric acid markets. It was irrational to make ammonia in plant involving high capital cost if nitric acid could be made direct in cheaper plant at the same cost, and it could not be doubted that recent developments in the Häusser process lent colour to those views. It seemed probable that the impending trials of that process with a 1500 litre bomb were likely to place it on a commercial footing. Some discussion had taken place with regard to the possibility of substituting a gas engine, or preferably a modified type of Humphrey pump for the explosion bombs, and such a method would have the added advantage that the calorific value of the gases or liquid fuels used could be converted into useful energy. The importance of using gases of high calorific value to obtain higher temperatures and yields should be emphasised, and there were methods by which coke-oven and similar gases could be enriched with that object. It was possible that Häusser plants could be usefully developed either as adjuncts to synthetic ammonia plants, at coke-oven plants, or in places where liquid fuel was cheap and the cost of making nitric acid relatively high.

Mr. J. H. West discussed the question of raw materials for synthetic ammonia and the manufacture of hydrogen and nitrogen. Coke-oven gas, where available, was, he reminded the meeting, an excellent source of hydrogen, as it could be separated from it by the Claude process of liquefying all gases except the hydrogen, after removing the carbon dioxide by absorption in water. A process had been worked out by himself and Dr. Jaques which combined the distillation of coal in a retort, the formation of water gas from the resulting coke, and the conversion of the carbon monoxide produced in those operations into carbon dioxide and hydrogen by reaction with steam in presence of a catalyst, thus giving the maximum possible yield of hydrogen from a ton of coal. Nitrogen could be made in an ordinary liquid air plant, the separation from oxygen being effected by fractional distillation. In the Haber process water gas was mixed with air producer gas so that sufficient nitrogen remained in the mixture after treatment for conversion of the carbon monoxide, the final adjustment to the exact proportions being made by adding a little pure nitrogen obtained from liquid air.

SECTION G.

ELECTRIC IGNITION.

"Some Recent Developments in Electric Ignition Apparatus for Internal Combustion Engines" was the subject of a paper by Dr. E. O. Turner. He said that as a consequence of the stimulus given to the manufacture of magnetos during the war period the subject had received more and more attention from engineers and physicists. The almost universal adoption on motor cars of some form of dynamo lighting and battery charging system had, however, revived the use of the induction coil as an alternative to the magneto. Certain difficulties in providing current interrupters to suit all conditions that arose were common to both induction coils and magnetos. The platinum-iridium alloy containing 25 per cent. of the latter material, although the most suitable alloy to use, had two drawbacks. It was expensive, and it was found that when interrupting unidirectional current a deposit of the positive contact was made at an apparently uniform rate on the negative contact face. If on the score of expense the percentage of iridium was reduced the material was made too soft to withstand the mechanical hammering to which it was subjected. Tungsten might be employed as a contact material; it was comparatively cheap, but unfortunately under certain circumstances the resistance between the closed contacts was apt to reach an unduly high figure. That was a serious drawback, particularly with magnetos. It was difficult to explain the increased contact resistance, and further information on the subject would be of great use to both makers and users of ignition apparatus. In the case of magneto ignition there were a number of drawbacks associated with magnetos having rotating armatures, rotating windings, and rotating contact breakers, but the recent introduction of cobalt steel for magnets provided a means of overcoming some of those difficulties, and it appeared likely that within a comparatively short period the use of tungsten magnet steel, as far as magneto manufacture was concerned, would be entirely superseded. It was too early to discuss the various arrangements which recently published patent specifications indicated were in course of development. There was little doubt, however, that the chief advantages which might be looked for in the near future would consist of a more compact structure, a shorter magnetic circuit, and a more thorough lamination of the armature flux path, thus ensuring a more efficient use of the magnet energy.

COMPOUND STRESSES.

Mr. C. E. Stromeyer dealt with the resolution of compound stresses. He said that while stresses were always balanced—the push and pull in a bar being the same at both ends—forces, when acting on masses, might be considered to be unbalanced. In spite of that fact, the process of resolving stresses was based on the law of acceleration of masses. A resultant force produced the same acceleration in a mass as was produced by the forces which it replaced. Similarly, resultant stresses produced the same effects (strains) which were produced by the stresses which they replaced. A series of points in a solid were fixed upon and expressions set up which determined the relative displacements of those points if subjected to a number of stresses acting in various directions. Those expressions contained terms which depended only on the intensities of the stresses and their directions and not on the relative position of the selected points. Those terms must be fulfilled by the resultant stresses, and thus a number of formulæ were obtained which determined the intensities and directions of the resultant stresses. Vector co-ordinates were employed. For stresses acting parallel to a single plane the simple rule was evolved that, adopting an arbitrary direction, all the angles which the stresses made with that direction must be doubled, and a polygon of stresses was then constructed with those double angles. The end points of the polygon might be looked upon as being the foci of an ellipse or of a hyperbola, whose major axes were equal to the algebraic sum of the stresses. The direction had to be halved. That result could, of course, be obtained from the formulæ evolved with the help of the law of acceleration. The author also dealt with the resultants of stresses in space. He explained the use which could be made of his method of resolving stresses for measuring the strains in celluloid which were revealed by polarised light.

* No. III. appeared September 29th.

BOOKS RECEIVED.

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London Shipping, 1922. Liverpool: *The Journal of Commerce*. Price 2s.

Glasgow Shipping, 1922. Liverpool: *The Journal of Commerce*. Price 2s.

North-East Coast Shipping, 1922. Liverpool: *The Journal of Commerce*. Price 2s.

Heat. By W. J. R. Calvert, M.A. London: Edward Arnold and Co., 41 and 43, Maddox-street, W. 1. Price 6s. net.

Income Tax Guide. By H. W. Palmer. London: The Financial Times, Limited, 72, Coleman-street, E.C. 2. Price 1s. net.

The Flow of Liquids in Pipes. By Norman Swindin. London: Benn Brothers, Limited, 8, Bouverie-street, E.C. 4. Price 3s. net.

Pumping in the Chemical Works. By Norman Swindin. London: Benn Brothers, Limited, 8, Bouverie-street, E.C. 4. Price 3s. net.

Labour Policy—False and True. By Lynden Macassey. London: Thornton Butterworth, Limited, 15, Bedford-street, W.C. 2. Price 7s. 6d. net.

Materials of Chemical Plant Construction: Non-metals. By Hugh Griffiths. London: Benn Brothers, Limited, 8, Bouverie-street, E.C. 4. Price 3s. net.

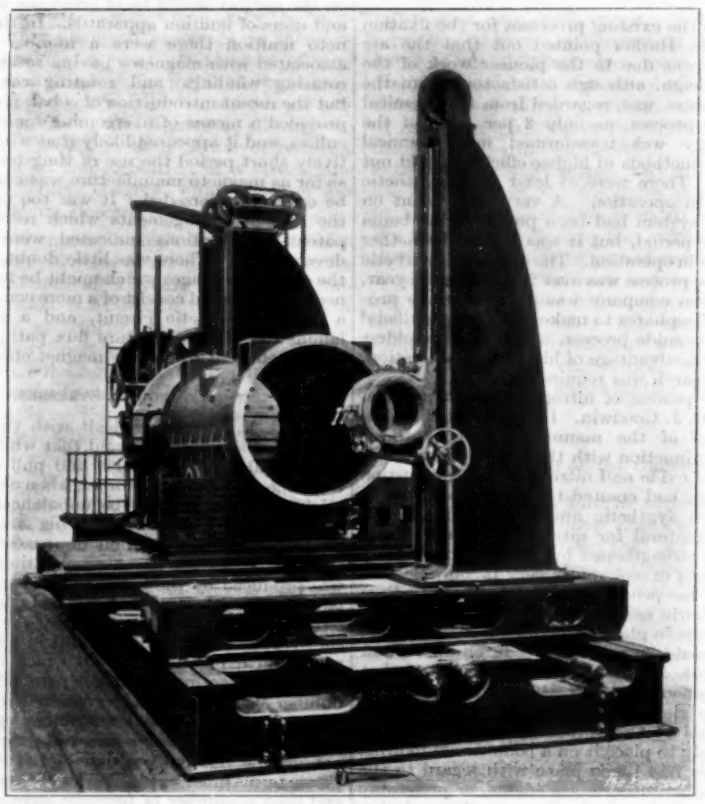
The General Principles of Chemical Engineering Design. By Hugh Griffiths. London: Benn Brothers, Limited, 8, Bouverie-street, E.C. 4. Price 3s. net.

The Weighing and Measuring of Chemical Substances. By H. L. Malan and A. I. Robinson. London: Benn Brothers, Limited, 8, Bouverie-street, E.C. 4. Price 3s. net.

Machine Shop Mathematics. By G. Wentworth, D. E. Smith, and H. D. Harper. London: Ginn and Co., 7, Queen-square, Southampton-row, W.C. 1. Price 5s. 6d. net.

Large Surfacing and Boring Machine

The views on this and the opposite page represent a large surfacing and boring machine—probably the largest of its kind that has hitherto been built. This machine has been designed and constructed by H. W. Kearns and Co., Limited, Broadheath, near Manchester, specially for performing the machining operations on steam turbine casings without re-setting. Its weight is approximately 100 tons. The machine embodies the latest improvements, namely a travelling spindle of large diameter and automatic facing motion. The spindle can be revolved either independently or simultaneously with the facing slide and the machine is capable of performing both boring and facing operations simultaneously. For boring work of medium diameter the facing slide does not revolve. Reverse motions are fitted both to the spindle and the facing slide, and the machine is fully automatic with reversible power feeds to the spindle, facing slide, vertical motion of the spindle slide and the horizontal and transverse motions of the table. Rapid



LARGE SURFACING AND BORING MACHINE

power traverse is fitted to all these movements as well as to the longitudinal movement of the boring stay along the bed and the vertical motion of the boring bar support. In addition to these movements the turntable, which is detachable, can be caused to revolve in either direction by power. It can also be turned by the automatic feed, enabling continuous milling to be performed in a circular path. The facing slide is of the slotted type which allows of the tools being placed in the most convenient positions, while for wide faces two or more tools can be used simultaneously.

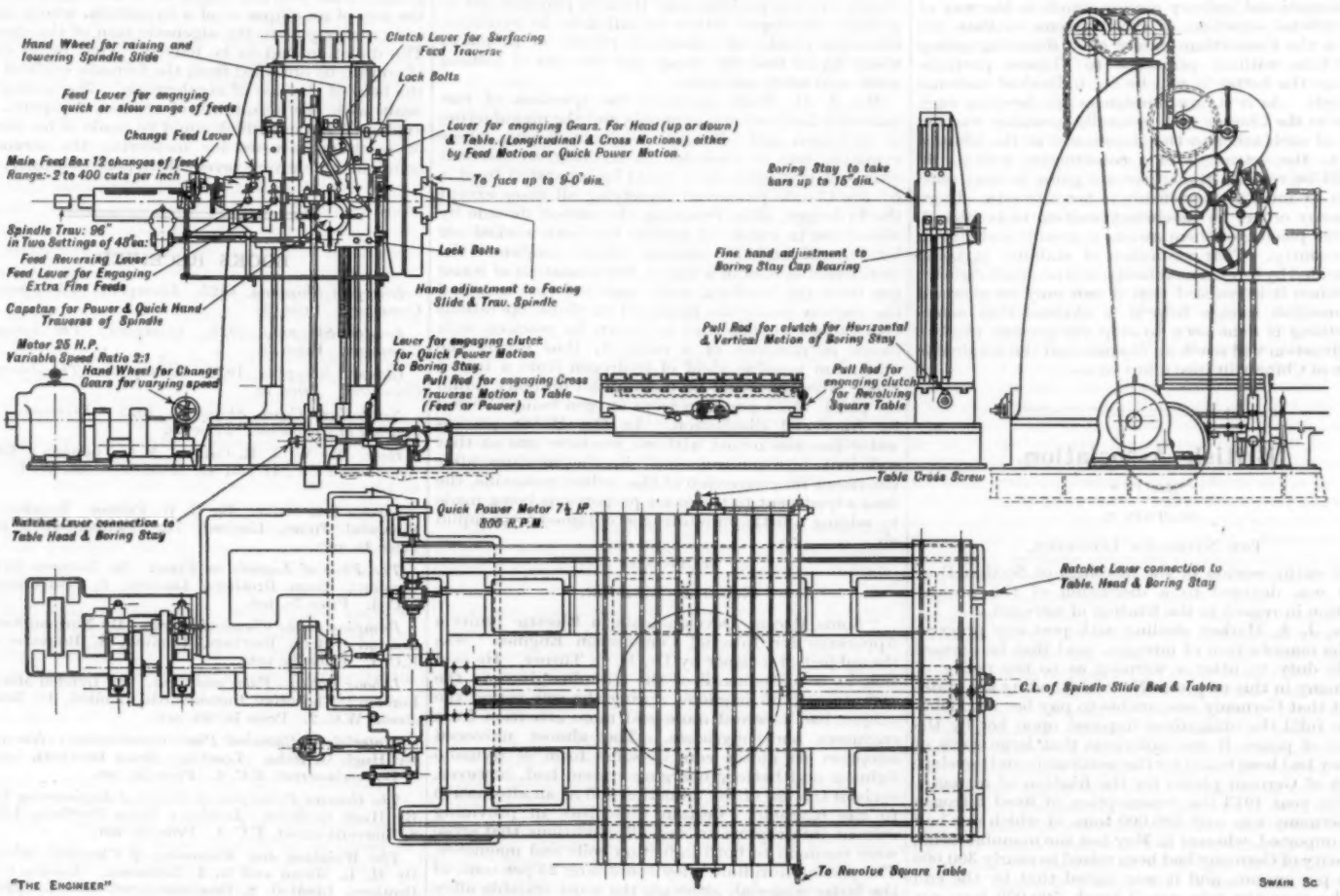
The spindle slide and the boring stay are balanced, the weights being carried inside the castings. The spindle slide and the boring stay can be moved together or independently, so that once the alignment has been got for the boring bar, it can be retained. Vernier scales are not fitted for this purpose, dial traverse indicators which give the reading of the height above any given date of line being used. These indicators are actuated by non-rotating screws, as already described in The Engineer. All the screws which operate the traverses are kept in tension and the end thrusts are taken by large bowl washers.

The capstan for the power and quick hand traverse for the spindle serves a double purpose. The handles used for moving the spindle require only a forward push to engage the automatic feed. The quick power motor circuit cannot be completed so long as the automatic feed lever is engaged. The traverse of the spindle of 48in. at one setting can be obtained anywhere within the range of the 96in. obtained at two settings. All the sliding surfaces are provided with oil boxes in the castings, and the oil is fed on to the sliding ways by wicks, while the bearings that run continuously are fed with oil by drip feed from a central supply, and the bearings for the intermittent motion have tell-tale grease cups. After setting the slides, locking is performed by T slots and bolts of large dimensions. In order to provide for wear, all the sliding surfaces can be adjusted by tapered gibs and end thrust on the traversing spindle and facing chuck is taken on ball washers of large diameters.

The following are the leading particulars of the machine:

Diameter of drilling and boring spindle	8in.
Traverse of drilling and boring spindle at one setting	48in.
Traverse of drilling and boring spindle at two settings	96in.
Maximum diameter machine will face	108in.
Number of feeds to spindle slide, vertical, longitudinal and transverse motions	12
Variation of above feeds, cuts per inch	2 – 96
Number of speeds to spindle and chuck	24
Variation of speeds to spindle and chuck, revolutions per minute	50 to 0.75
Vertical traverse of sliding head	8ft.
Maximum distance, centre of spindle to main table	9ft. 6in.
Size of main table	168in. by 96in.
Size of detachable turn-table	96in. by 96in.
Longitudinal traverse of table	144in.
Transverse traverse of table	120in.
Width of main bed	139in.
Maximum distance between facing slide and boring stay	18ft.
Maximum diameter of bar machine will take	15in.
Floor space required	40ft. by 24ft.

The machine is driven by a 30 brake horse-power electric motor, while a separate motor is fitted for operating the rapid power traverse motion. All the motions are controlled from the platform attached to the spindle slide, and duplicate control gear of the "push button" type is fitted for operation from the most convenient positions. Reversing to all motions except the feed, which is mechanical, is obtained electrically.

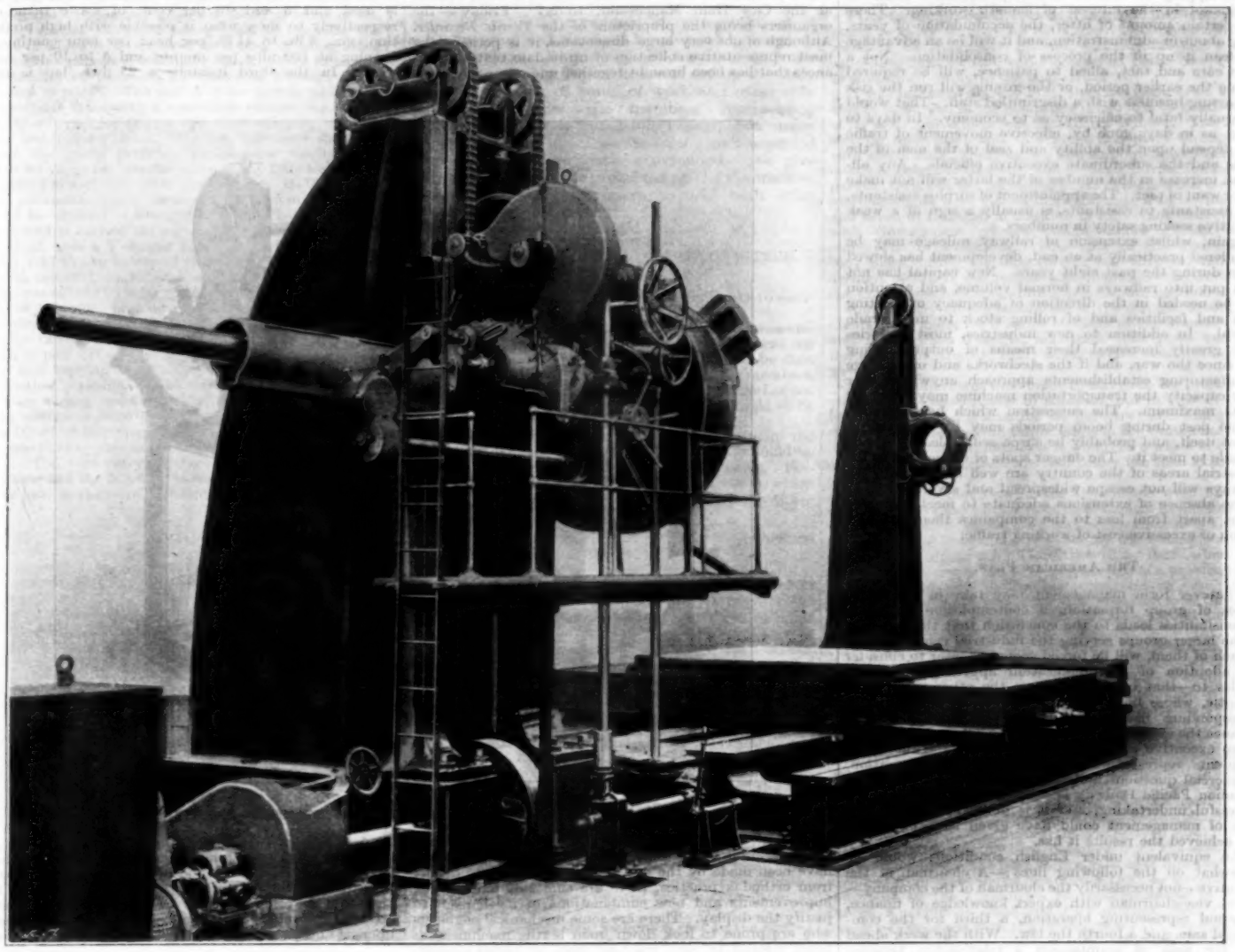

Hand Wheel for raising and lowering Spindle Slide
Clutch Lever for Surfacing Feed Traverse
Lock Bolts
Feed Lever for engaging quick or slow range of feeds
Change Feed Lever
Lever for engaging Gears. For Head (up or down) & Table. (Longitudinal & Cross Motions) either by Feed Motion or Quick Power Motion.
Main Feed Box 12 changes of feed Range:- 2 to 400 cuts per inch
To face up to 9-0" dia.
Boring Stay to take bars up to 15" dia.
Spindle Trav: 96" in Two Settings of 48" ea:
Lock Bolts
Feed Reversing Lever
Feed Lever for Engaging Extra Fine Feeds
Fine hand adjustment to Boring Stay Cap Bearing
Hand adjustment to Facing Slide & Trav. Spindle
Capstan for Power & Quick Hand Traverse of Spindle
Pull Rod for clutch for Horizontal & Vertical Motion of Boring Stay
Motor 25 H.P. Variable Speed Ratio 2:1
Lever for engaging clutch for Quick Power Motion to Boring Stay.
Hand Wheel for Change Gears for varying speed
Pull Rod for engaging Cross Traverse Motion to Table (Feed or Power)
Pull Rod for engaging clutch for Revolving Square Table
Table Cross Screw
Quick Power Motor 7½ HP. 800 R.P.M.
Ratchet Lever connection to Table Head & Boring Stay
Ratchet Lever connection to Table. Head & Boring Stay
C.L. of Spindle Slide Bed & Tables
To Revolve Square Table
"The Engineer"
Swain Sc

ELEVATIONS AND PLAN OF SURFACING AND BORING MACHINE

LARGE SURFACING AND BORING MACHINE

H. W. KEARNS AND CO., LTD., BROADHEATH, NEAR MANCHESTER, ENGINEERS

(*For description see opposite page*)



Railway Management.*

From time to time the fingers of bureaucrats have itched to catch hold of railway management to reform and remodel it on a Whitehall pattern, but public opinion, in the light of war experience, has evinced a very decided dislike to experiment in the direction of Government ownership of industry, and it has thus happened that railways have emerged from the war's turmoil still under private ownership, but coupled with a large measure of State control. From the point of view of the trader, as well as the travelling public, it should be capable of demonstration that controlled private ownership is preferable to uncontrolled State ownership, and it will be upon future management that proof of this will lie. We must always remember that public opinion is fickle, always alert and prone to criticise. At some time in the future—near or distant—grievances, fancied or real, will serve to resurrect the cry for State railways. Upon management, good or bad, the appreciation or otherwise of a company's duties to the public as compared with a company's rights, will depend the period of freedom from attack on private ownership.

Reconstruction has been the word most commonly used to describe the recent process of State policy toward transport. Consolidation, financial and physical, is, I think, a better phrase to use as descriptive of the Act of 1921.

The Railway Act, 1921.

Let me recapitulate very briefly the principal liabilities and assets of the companies under the Act. The groups are to provide efficient services and conveniences, and upon application to the Railway and Canal Commission by any body of persons representing the public, or trade, or any particular locality, an order may be made upon a company to improve facilities, including works or extensions, at a cost not exceeding, in any one case, £100,000. Provision is made for the adoption of standardisation of ways, plant and equipment—including electrical operation, type, frequency and pressure of current—also for co-operative working or common user of rolling stock, workshops, manufactories and other facilities. Statistics are compulsory under certain heads, and here I would remark that figures may be made to represent facts or become the finest and easiest form of camouflage. There are figures of fact and there are figures of deduction. An average is not always a fact, and may easily become a disease.

We may regard as an asset the physical change brought about by forming four large groups ranging from 2000 odd to 7000 miles of railway. The strong and the weak, the large and the small companies, as far as practicable, without severing the thrown-out tentacles of certain companies, are merged into fairly equitable geographical groups. To quote the Act, "under efficient and economical working and management," the linking up in one organisation of companies in groups should represent an asset in efficiency as well as economy, of no mean proportion.

The charging powers of the combined companies we may regard as a dividend-earning charter. The rates and fares are to be so adjusted from time to time as to yield "under efficient and economical working and management" a defined net income.

When we come to the clauses dealing with labour, there will, I know, be a difference of opinion as to whether the setting up of Central and National Wages Boards is an asset or liability. I need scarcely remind you of past unfortunate and costly disputes between the companies and their staffs, nor of the efforts which were made through the establishment of Conciliation Boards to bridge differences of opinion between those who work and those who pay. For some time prior to and during 1911, railwaymen saw workers, side by side with themselves in other industries, commanding increasingly higher wages for not more onerous work than that upon the railway, and they struck. Again, during the war, the cost of living precipitated a conflict, and a minimum wage, with a sliding scale beyond it, was fixed by agreement with the Government.

Railway Employees.

It has been contended that the unions drove too hard a bargain in the time of national emergency; but be that as it may, I hope there will be a consensus of opinion that men engaged in such essential work as transport should be paid, in the words of Mr. Rowntree, "sufficient to maintain a reasonable standard of comfort, should have reasonable hours of work, reasonable economic security during the whole working life and in old age, and a reasonable share with the companies in determining the conditions of work." If one could add also a direct monetary interest in the prosperity of the industry in which they are engaged, it would probably clinch the combination of railway capital and railway labour, but I fear the time for that is not yet. The railwayman, in common with the rest of mankind, will only travel through this world once. He will not pass this way a second time. He is entitled, in return for his services, to as comfortable a journey as the transport industry can give him.

The remaining asset secured by the Act is without doubt of first importance. I refer to the clauses providing for compensation by reason of Government control. When the large sum provided for by the Act is distributed, it will give the new groups an excellent start in life—ready cash to tide over possible fluctuations in net income during the process of amalgamation, and for some time thereafter, cash payments to enable arrears of maintenance to be overtaken, with ample departmental reserves to meet future renewal. Never, since railways have been, has the financial situation proved so sound. And it is well that it is so. There should be no question of poverty in the transport industry, with its obligations to trade and the public in fetching and carrying people and things, food and clothing, raw material and finished manufactures, the fruits of the earth and home comforts, and what is of almost equal importance, its ability to aid industry in general by reason of its purchasing power as the largest individual buyer of the output of mines and factories.

Management under Groups.

Transport, of all industries, needs flexibility and prompt decision. It is fighting against time all the time. An organisation clothed with authority to deal with problems as they arise is essential. Delay leads to public irritation, piles up correspondence and discredits headquarters in the minds of distant officials. Much—very much—will be expected of the new groups; more, probably, than they will be able to achieve. Criticism—intelligent and otherwise—is certain. Upon the atmosphere created by management will depend success or failure, the stability or injurious amendment of the assets contained in the Act of 1921. Transport holds the master key of all the key industries. It must, in vital national interests, keep abreast of industrial needs. The Act contains a spur to this end in the shape of the proviso that "efficient and economical working and management" is a justification for the standard revenue. Under this clause, it is obvious that management may be quickly called in question by the State or any association representing the public. Management in effect will be living more or less in a glass house, at which a brick may be aimed at any time. The problems ahead, apart altogether from the actual movement of traffic and the maintenance of property, are such as to absorb all the time and energy of those who are called upon to manage the groups. The welding of the constituent and subsidiary lines into an harmonious and economical whole will not be the work of a day. Economy will demand the dismantling of certain manufacturing

* Abstract of presidential address delivered by Sir Sam Fay at the third annual meeting of the Institute of Transport, Monday, October 2nd, 1922.

and maintenance establishments and the enlargement possibly of others. Practices and forms of years' standing will have to give way to uniformity where gain is obvious. The standardisation of rolling stock and material, the selection of the best in each case, will occupy much time and need careful investigation before decisions are taken —overlapping of control and responsibilities must be eliminated in the interest of smooth working. There is a certain amount of litter, the accumulation of years, lying about in administration, and it will be an advantage to clean it up in the process of consolidation. Not a little care and tact, allied to patience, will be required during the earlier period, or the groups will run the risk of starting business with a disgruntled staff. That would be equally fatal to efficiency as to economy. In days to come, as in days gone by, effective movement of traffic will depend upon the ability and zeal of the men in the ranks and the subordinate executive officials. Any all-round increase in the number of the latter will not make up for want of tact. The appointment of surplus assistants, and assistants to assistants, is usually a sign of a weak executive seeking safety in numbers.

Again, whilst extension of railway mileage may be considered practically at an end, development has slowed down during the past eight years. New capital has not been put into railways in normal volume, and attention will be needed in the direction of adequacy of existing lines and facilities and of rolling stock to meet trade revival. In addition to new industries, most factories have greatly increased their means of output during and since the war, and if the steelworks and other large manufacturing establishments approach anywhere near their capacity the transportation machine may be taxed to its maximum. The congestion which has appeared in the past during boom periods may be expected to repeat itself, and probably be surpassed, unless provision is made to meet it. The danger spots of congestion in the industrial areas of the country are well known, and the railways will not escape widespread and severe criticism in the absence of extensions adequate to meet improved trade, apart from loss to the companies themselves by reason of excessive cost of working traffic.

The American Plan.

Whatever form management may take in the initial stages of group formation, a contemplation of future responsibilities leads to the conclusion that the directors of the larger groups serving the industrial centres, if not of each of them, will be forced sooner or later to consider the adoption of an organisation approaching—if not similar to—that of companies on the other side of the Atlantic, whose lines cover large tracts of country with corresponding liabilities. As an example, one may instance the Canadian Pacific Railway, which is controlled by an executive consisting of a president and four vice-presidents representing respectively finance, operation, commercial questions, and the law. No one can say the Canadian Pacific Railway is a badly managed or an unsuccessful undertaking, and it is doubtful if any other form of management could have given the satisfaction and achieved the results it has.

The equivalent under English conditions would be somewhat on the following lines:—A chairman of the executive—not necessarily the chairman of the company—a first vice-chairman with expert knowledge of finance, a second representing operation, a third for the commercial side, and a fourth the law. With the work ahead and the task of maintaining a relationship between expenses and earnings, sufficient to ensure an adequate net return, an expert executive of this type would find itself living in a furnace of activity. The objective of their efforts would be the attainment of the best results with the least expenditure of time and money.

They would need a broad perspective and a keen sense of proportion with time to stand aside and survey themselves and the trend of their work in relation to public obligations as well as the company's welfare. The trivial would have to be excluded from their offices, and formality —a parasite of centralisation which tends to destroy it—reduced to a minimum.

A corollary of such an organisation would be the splitting up of the lines into divisional areas under divisional superintendents—say, three or four for each group—of a size which, after taking into consideration density of traffic and other circumstances, come within the limits of human capacity. Their responsibilities aided by technical assistants would cover operation, maintenance and renewal of line and rolling stock as well as the commercial business within their area. They would thus relieve headquarters of a mass of current work. Being chosen wisely and well, the superintendents could be left a wide discretion with encouragement to develop the areas under their charge and to seek advice when in doubt. Their direct contact with traders and people in general would enable them to familiarise themselves with the conditions, ideas and needs of each town and district and obviate formal communications and orders from the executive. The public are always ready to lend an ear to charges of inefficient management, and the further away the executive, the more difficult is counter-attack. With the tentacles of transport in every factory, office and home in the land, the nearer the daily management is to the points of the tentacles, the better. Distant management tends to appear impersonal; conversely, local management becomes personal.

Amongst other advantages, divisional sub-management might be expected to soften the transfer from constituent company to group control; jarring elements—and there are certain to be found some in the process of consolidation —would be less discordant than under centralised detailed administration.

A Travelling Show-room.—There is now being organised by a company, known as the British Train Traders, Limited, with offices at Canada House, 42, Blackfriars-road, London, S.E. 1, a scheme for sending a train on a long tour through Canada, with the object of exhibiting British manufactures and soliciting orders. Space can be rented on the train for the display of samples, and expert salesmen will be employed to attend to prospective customers. It is proposed subsequently to extend the scheme to cover other countries.

Textile Machinery Exhibition in Manchester.

An exhibition of textile machinery and accessories, which promises to be of unusual interest, is being opened at the City Hall, Manchester, to-day — Friday — the organisers being the proprietors of the *Textile Recorder*. Although of not very large dimensions, it is perhaps the most representative collection of up-to-date textile appliances that has been brought together under one roof since the war, and it serves to demonstrate that if few attempts have been made by the designers and builders to depart from orthodox practice, there are sufficient refinements, improvements and new combinations of mechanism to justify the display. There are some mechanical engineers who are prone to look down upon textile machinery as being inferior to, say, machine tools or power-generating machinery as regards both design and workmanship. A visit to the present Exhibition will tend to dissipate this idea. It is obvious that textile machinists are now quite alive to the introduction of refinements, both in the principles and the design and in quality of workmanship. Pressure of foreign competition has, no doubt, helped builders of textile machinery to understand that appliances which were considered good enough for their grandfathers will no longer serve British manufacturers, if the latter are to maintain their position at the head of the textile industry of the world. Developments have taken place in the mechanism for producing fine yarn from the mixing and blending of the raw product to the dyeing or printing of the finished fabric. With the increased use of fine yarns has come the improvement of the cotton combing machine, and many firms who previously utilised carding machines only now install efficient combing machinery. In this connection, a new development is to be seen at the Exhibition which is claimed to be an improvement upon anything which has hitherto been made.

One of the most interesting exhibits is a cotton "opener" of original design, made by Youlten Openers, Limited, Bridge-street, Manchester. The machine has been designed especially to obviate damage to the cotton fibres during the opening process. The machine comprises essentially a large opening space, formed by a slowly revolving perforated horizontal cage, which is continuously scavenged by a rotary brush, and the cleaning area is therefore rendered more efficient. A rapidly revolving rotor occupies the lower portion of the cage. This rotor comprises a shaft on which steel stampings are closely packed on double right and left-hand spirals, which meet at the centre. The tips of the stampings are rounded, and when revolving at high speed form an evenly serrated surface. The cotton coming into contact with the rotor is thrown off against the inner surface of the cage and falls back again on the rotor, receiving only light and very rapid taps or vibration while acted upon by a strong current of air. The opened cotton is then immediately blown out of the machine.

Dobson and Barlow, Limited, of Bolton, exhibit the Tunstall combing machine, which is a double-sided machine with six heads on each side, the two sides being interdependent. No cams are employed in actuating the nipper, top comb and detaching roller mechanisms. The opposing nipper mechanisms are bonded together and actuated by a single swing shaft, the timing of the swinger nippers being identical on both sides. The top combs are entirely independent of the nippers, and each nipper mechanism is built on a rigid frame. There is one feed roller to each nipper working on an auxiliary plate, to ensure uniform pressure across the width of lap. The width of a lap is 10½in. and the weight with long staple cotton 500 to 550 grammes per yard.

The new Nasmith combing machine, shown by John Hetherington and Sons, Limited, Manchester, is of the so-called double type, but is really two independent combers built back to back on the same framing. On one side is shown three kinds of combing of Egyptian cotton—(*a*) semi-combed or super carded, (*b*) coarse combing, and (*c*) fine combing, the same fibre being used in each case. In the first two instances, a 35 dwt. lap is used and 5 and 10 per cent. of waste taken out respectively to show what is possible with high production, viz., 4 lb. to 4½ lb. per head per hour continuous running at 100 nips per minute and 5 to 10 per cent. waste. In the third instance a 25 dwt. lap is used, and 15 per cent. waste taken out to show the fine product. On the other side of the machine ¾in. American staple is used, one section working a 35 dwt. lap with low waste and the other a 25 dwt. lap with 15 per cent. waste.

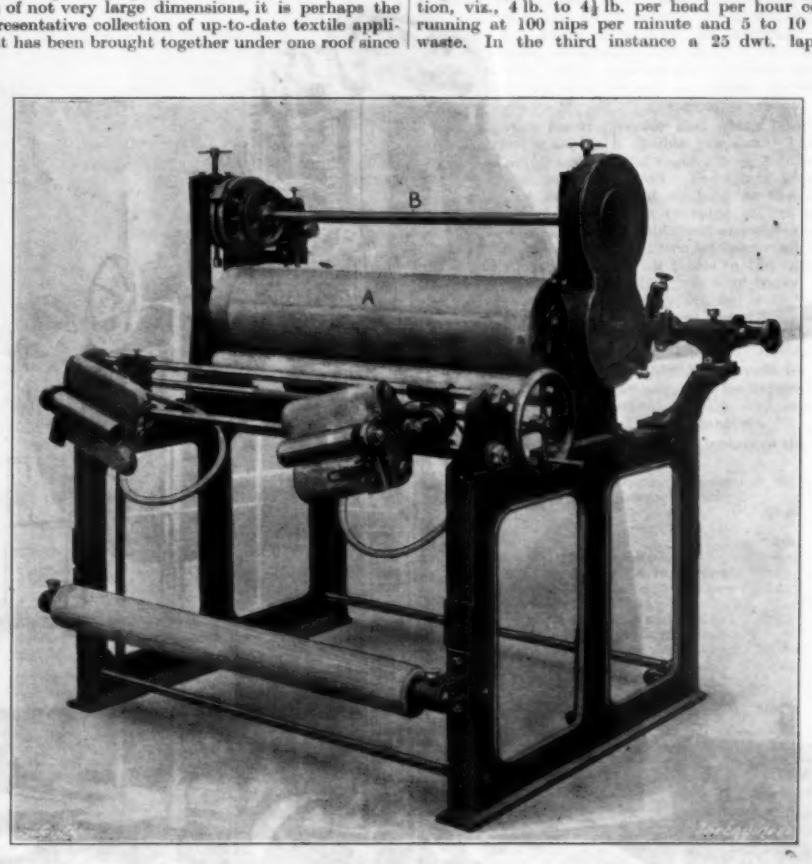


FIG. 1—FOXWELL AUTOMATIC SELVEDGE STAMPING MACHINE

Daniel Foxwell and Son, Cumberland-street, Manchester, amongst other machines, show an ingenious automatic

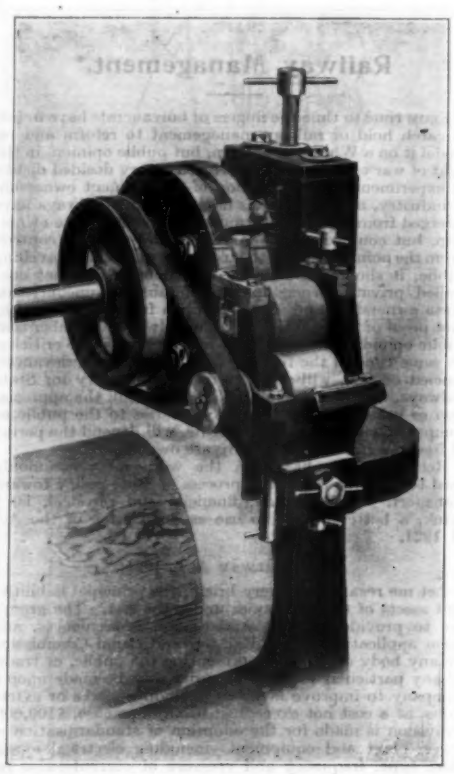


FIG. 2—SELVEDGE PRINTING DEVICE

selvedge stamping machine, of which we give illustrations in Figs. 1 and 2. The machine has been specially designed for the accurate stamping of trade marks, lengths, &c., to ensure that these marks are printed absolutely correctly on the selvedge of the cloth. The cloth is drawn through the machine by a rolling and lapping arrangement or any other suitable machine. It passes around drum A, which

revolves in ball bearings, the cloth itself driving this drum, which, in turn, drives the shaft B through gear wheels. On this shaft is mounted a split cast iron wheel in which is a bevelled groove, half the bevel being on either side of the split. This is for fixing the dies. The face of the dies travels in a circle, the circumference of which is 36in. An inking arrangement is fitted. To ensure the selvedge of the cloth being guided accurately under the dies, Foxwell's pneumatic guider is fitted in front of the machine, special attention being paid to the side, the selvedge of which it is required to stamp, it being fitted with an extra pair of retaining or check rollers to ensure the minimum of variation on that side through slight differences of width. The end of roller A over which the dies revolve is fitted with a removable rubber ring, which acts as a soft pad for the stamps, thus ensuring the dies against unnecessary wear. We are informed that the machine has given perfectly satisfactory results at a speed of 80 yards per minute without any attention.

Messrs. Foxwell and Son also exhibit McBride and Lowes pneumatic cloth creaser. In this machine the cloth to be creased is brought either in batches or on wagons, and is carried through tension rails and rollers, as required, over a V-shaped tube, which imparts a preliminary fold in the centre of the piece. The cloth then passes in doubled width with the selvedges through a pair of pneumatic guider headstocks G—Fig. 3—the middle of the piece passing round a vertical aluminium cone roller C, which is mounted on ball bearings and gradually tapers towards the bottom. It then passes through a pair of wooden nip rollers, and thence to a rolling and lapping or plaiting down arrangement or to any other machine. The guiding headstocks G are carried on sliding brackets E, which are adjustable for varying widths of cloth by means of right and left-hand screws D, which are operated in unison from either side of the machine by means of hand wheels H and bevelled gears I. The rods carrying the sliding brackets are set at an angle and the brackets themselves are made to tilt, more or less, as they are adjusted for the width of cloth.

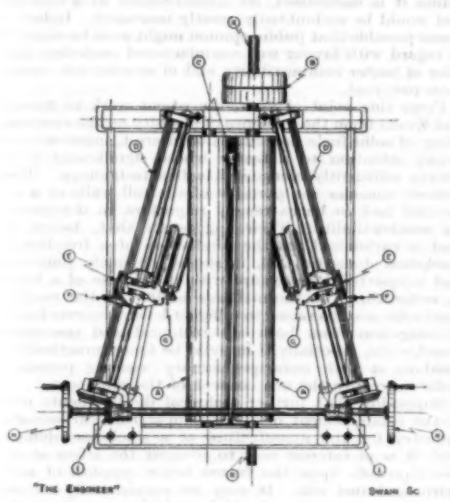


FIG. 3—McBRIDE AND LOWES PNEUMATIC CLOTH CREASER

The angle of the slide rod and the angle of tilt are such that whatever the width of the cloth be creased, the line of the guide of the nip rollers and the plane of the faces of the guider plates are in the same plane as that of the cloth, if the guide headstocks are not present. Either headstock can be moved independently of the other by means of a hand wheel F and locking devices are provided to prevent one headstock being accidentally moved without the other when not required to do so.

Humidifying apparatus forms a considerable section of the Exhibition. One system of humidification shown by Herbert Smethurst and Sons, Limited, John Dalton-street, Manchester, employs what is called an air fountain, in which an automatically controlled fine jet of water is impinged upon by a jet of compressed air, which, expanding with great force immediately on release from the nozzle, vaporises the water to such a fine degree that the surrounding atmosphere absorbs it without precipitation or condensation. Another type of humidifying apparatus is shown by Cleworth, Wheal and Co., Limited, Castleton, near Rochdale. This consists of a centrifugal fan connected to a water storage tank with a specially formed surface, and these are combined with air and water heaters, the moistened air being distributed by means of ducts. A description of this apparatus has already been given in THE ENGINEER.

Other exhibitors in the humidifying section are the Andrew Machine Construction Company, Limited, Stockport; James Gordon and Co., Limited, Kingsway, London; and the Airton Engineering Company, Limited, Leeds.

INSTITUTION OF CHEMICAL ENGINEERS.—The thirteenth meeting of the provisional committee of the Institution of Chemical Engineers was held on Wednesday, September 20th, 1922. The solicitors announced the receipt from the Board of Trade of a letter, stating that "the application for a licence to register the Institution under the provisions of Section 20 of the Companies (Consolidation) Act, 1908, had now been entertained." The secretary reported that over 180 applications for membership had been received, and that the Selection Committee had considered a large number of these applications, and recommended that the names of the gentlemen selected in the first instance be brought before the first Council as soon as formed. The report of the sub-committee on the relations between the Chemical Engineering Group and the Institution of Chemical Engineers was considered and action was postponed until a later date. A vote of thanks was carried unanimously to Mr. Pilcher and the Council of the Institute of Chemistry for their kind assistance in explaining fully their office organisation. It was arranged that the next meeting of the Committee should be held on Wednesday, October 18th, 1922.

Working Hours.

No. I.

As the result of an effort made by Labour in 1919 to reduce the working week from forty-seven hours to forty-four hours in the engineering and allied trades, a special Committee composed of representatives of the Engineering and National Employers' Federation, the Shipbuilding Employers' Federation, and the Unions' Negotiating Committee, was set up to study the whole question of hours of work and other subjects. There were six members representing employers and six representing labour, but many changes took place in the *personnel* during the period over which the investigations extended. We give to-day part of the report presented by the Committee, and propose in future issues to deal with other portions.

REPORT OF JOINT INVESTIGATING COMMITTEE.

FOREWORD.

IN presenting this report the Committee desires to make the following statement:—

In view of the fact that the Committee was representative of both employer and employee interests, it was felt that no statement of views or deductions from the data collected could be acceptable to the whole of the members. On the other hand, the data collected was altogether too voluminous to be presented as it stood, nor could it be readily understood or used by our constituents.

The only course seemed to be the presentation of the salient facts, tabulated in such a way that they could be readily ascertained and shown in their true value. Fortunately, the data lent itself to natural subdivision, which made possible its presentation in sections dealing with:—

(*a*) The answers to the questionnaire;
(*b*) The visits to works in June and July of 1920, when business was apparently plentiful;
(*c*) The continental visits in April and May of 1921;
(*d*) The visits to works in August, 1921, when trade was decidedly bad.

It will be noted that in the reports of visits to home works the subject matter has been arranged so as to present the conditions pertaining to the industry as a whole, whereas in the reports of the continental visits the report of each visit is complete in itself. It was felt that in regard to the investigations at home we were more concerned with the general conditions than with the conditions pertaining to individual firms, and as the wide range of visits made enabled us to ascertain the general conditions, they are presented in that form.

On the other hand, the widely varying conditions obtaining in the territories covered on the Continent and the lack of time and opportunity to make the very thorough investigations which have been made at home, rendered it impossible to treat these reports in quite the same way.

In regard to the preparation of this report, the Committee desires to state that every effort has been made to maintain as far as possible the wording and sense of the daily reports which were prepared by the Committee at the time of each visit.

The Committee feels that without a visit to the United States its work must be regarded as incomplete.

INTRODUCTION.

At the end of 1918 an agreement was entered into between the employers' organisations and the workpeople's organisations in the shipbuilding and engineering industries, which provided that the normal working week on and after January 1st, 1919, should consist of 47 hours, with one break in the day.

Very shortly after, however, a formal demand was made by the operatives' organisations for a further reduction of the normal working week to one of 44 hours. This was opposed by the employers' organisations on the ground that a shorter working week was economically impossible and, further, that the 47-hour week had not been in operation for a sufficient length of time to show its effects on production. Eventually, at a conference held on August 28th, 1919, the application for a 44-hour week was withdrawn and a memorandum agreed to as follows:—

> "That a Joint Committee representative of the employers and of the unions' Negotiating Committee be appointed to investigate the economic relation of production to hours of work, and in this connection, the methods of manufacture in the shipbuilding and engineering industries in this and other countries."

This memorandum, after submission to the constituents of both parties, was ratified, and a preliminary conference to consider methods of investigation took place in January, 1920, and a Joint Committee, consisting of six representatives of employers and six representatives of trade unions, formally came into being and held its first meeting on March 23rd, 1920.

The Committee, desiring certain detailed information, prepared and issued a questionnaire to a number of representative firms, requesting the desired information in confidence. The questionnaire dealt with the following matters:—(1) Export trade; (2) foreign competition; (3) equipment of works; (4) overtime, night shift, and other questions relating to hours; (5) systems of payment; (6) efficiency of output; (7) welfare of workers, &c.

It was then decided to visit representative engineering and shipbuilding establishments in all parts of the United Kingdom for the purpose of studying at first hand the matters covered by the terms of reference, and to see the actual working conditions prevailing in the shops. During June and July of 1920 twenty-one engineering and shipbuilding establishments were visited.

Unfortunately, at this stage, serious illnesses, affecting several members of the Committee, including the Joint Chairmen, held up all business for a period of three months and led to several resignations, and the position was further complicated by the resignation of one of the Joint Secretaries.

When the Committee, with the new members who had been appointed to fill the vacancies, resumed work in the autumn of 1920, provisional arrangements were made for a visit to the United States, which, unfortunately, had to be cancelled shortly afterwards, owing to the fact that the bulk of the members were prevented from leaving this country at that time, and to difficulties caused by the coal strike, and also to the lengthy negotiations as to working conditions in the engineering and shipbuilding industries which were then taking place.

Prior to the proposed visit to America it had been proposed to carry through an extensive visit to engineering works in the Manchester district, and this also had to be cancelled, most of the works concerned being compelled to shut down owing to the coal strike.

It was not until March, 1921, that the Committee were able to meet, and in the meantime it had lost by death one of its most active members, Mr. Oliver Winder. The first step on resumption was to arrange and carry through a very useful visit to engineering and shipbuilding establishments in Belgium, Germany and Holland, during the latter part of April and the beginning of May, 1921, when eleven establishments were visited in Belgium, four in Germany, and seven in Holland, in addition to important interviews with Government officials, trade union officials and employers' organisations. This visit to the Continent took place during the long further coal dispute, and on account of this it was impossible to continue the work of the Committee in England until the dispute had ended.

Immediately on the conclusion of the dispute, arrangements were made for a series of visits in the Manchester and Birmingham districts, and these took place during the month of August, 1921, when twelve establishments were visited.

A further effort was then made to carry out the proposed visit to the United States of America, but in view of the reports as to the stagnation of industry, affecting particularly engineering and shipbuilding in the United States, it was reluctantly decided that it would be a waste of time and money to undertake the visit under the then existing conditions.

Many of the members of the Committee were busily engaged in the succeeding two or three months in successive conferences with regard to working conditions in the industries, and it was not possible for the Committee to resume work again until December 13th, 1921, when it was decided to put in hand the preparation of a provisional report. The dispute in the engineering industry and the subsequent lock-out prevented this intention from being carried into effect, and as a result this report could not be finally approved until July 4th, 1922.

In order to indicate the difficulties under which the Committee has had to work, it may be mentioned that, including one of the Joint Secretaries, no less than ten changes have taken place in the *personnel* since it was originally appointed, and of the original fourteen members, including the Joint Secretaries, only five are now on the Committee.

Owing to the long period over which information has been collected, and the changes in conditions which have taken place during that time, the report is drawn up in chronological order. The first two sections relate to information concerning the shipbuilding and engineering industries respectively during the years 1913 and 1919, this information having been obtained from the answers to questionnaires. The next section relates to information obtained from these industries during 1920, as a result of the visits of the Committee to establishments in the United Kingdom in June and July of that year. The fourth section deals with the information obtained during the visits to Belgium, Germany and Holland during the end of April and the beginning of May, 1921, and the fifth section relates to information obtained during the visits of the Committee to engineering establishments in August, 1921.

The Committee desire to record their appreciation of the courtesy which they have received from shipbuilding and engineering employers, both at home and on the Continent, on the occasions of their visits, and to add to this expression of appreciation a word of thanks for the frank way in which any questions put have been answered.

SECTION I.—SUMMARY OF INFORMATION FURNISHED IN WRITTEN FORM BY REPRESENTATIVE SHIPBUILDING FIRMS AT THE REQUEST OF THE COMMITTEE.

The information relates to the years 1913 *and* 1919.

Number of Employees.—The numbers employed in all the firms were as follows:—

	1913.	1919.
Males over twenty-one	53,843	63,384
Females over twenty-one	74	669
Males under twenty-one	13,924	18,457
Females under twenty-one	35	149
Males unclassified	2,050	2,250
Sex unclassified	599	—
Total (males)	71,867	87,159
Total (females)	109	818
Grand total	72,466	87,977

It will be noted that the number of employees differs from the total given in the analysis relating to output, and also in the analysis relating to horse-power, and this is due to the fact that the figures for output and the figures for horse-power furnished by some firms were not clear, or could not be brought into comparison and were left out of these tables.

Equipment and Plant.—Comprehensive information is given by all the firms as to their mechanical appliances, and in a large number of cases additional plant was installed in 1919 as compared with 1913.

A good deal of information is supplied showing that pneumatic, electric and hydraulic machines have been introduced to a considerable extent as between 1913 and 1919, and it is stated that the results showed a sectional increase in output. It is also stated in a number of cases that the increased output has been accomplished with a reduced physical effort.

Oxy-acetylene, electric welding and cutting appliances have been introduced to a considerable extent as between 1913 and 1919, and it is reported that output has been increased in general.

Considerable opposition appears amongst shipyard men to the introduction of new appliances. In a number of cases the objection of the men tends to decline as they get

used to the new methods. It is stated that objection is made to the introduction of pneumatic riveting, also to the full use of new appliances, and that the men insist on the same piece rates, even although the new methods enable much more output to be obtained. It is stated in certain districts that the Boilermakers' Society insist on an unnecessary number of men on cutting plants.

Electric lighting was practically universal in 1919, whereas in 1913 gas and oil flares were still in use in several yards.

In regard to ventilating arrangements for shops, no very marked change took place between 1913 and 1919.

Heating arrangements were common in the shops in both years and no material change is reported.

Horse-power Available.—Taking the firms who supplied information on this subject, the position is as follows :—

	1913.	1919.
Total horse-power	63,895 ..	99,519
Number of employees	63,934 ..	76,076
Average horse-power per employee	.99 ..	1.31
Percentage increase = 32.		

Proportion of Normal Workers Employed on Machines.—The percentage of total manual workers in each shop employed either on fixed or hand machines varied enormously from firm to firm. Taking the average of all the percentages furnished by the firms reporting, the percentage for 1913 was 19.1 and for 1919 26.1.

Hours, Timekeeping, Overtime, &c.—In 1913 about half the firms worked 53 hours and the remainder 54, with the exception of one firm that worked 52. In 1919 the 47-hour week was in universal operation.

In 1913 the two-break system was in universal operation, but the length of the breaks varied. In 1919 the single break of one hour was almost universal.

The following table shows the average number of hours worked per week per employee in each year :—

	1913. Hours.	1919. Hours.
Time workers only	48.42 ..	43.83
Piece workers	42.49 ..	40.98
All workers	45.90 ..	42.50
Percentage ratio of total overtime to total normal day-shift hours	4.07 ..	2.88

Ten firms out of thirty-six worked a night shift in 1913 and thirteen in 1919. In general, in 1913 the night shift consisted of 57½ hours. In one case it was 55 and in another case 60. In 1919 there were much greater variations in the night-shift hours, varying from 45 to 60, but a number still retained the old 57½.

The percentage of night-shift hours to normal day-shift hours in the case of the firms who furnished information for both years was :—1913, 1.92 ; and 1919, 4.66.

The following shows the position with regard to holidays :

	1913. Days.	1919. Days.
Works idle due to authorised holidays..	16.75 ..	18.24
Works idle due to unauthorised holidays	3.35 ..	6.29
Percentage of all holidays to total days worked per annum	6.36 ..	8.29

It must be borne in mind that these figures are average figures, and that the actual figures vary very considerably from firm to firm.

The information as to the time lost owing to weather causes is somewhat incomplete. One firm remarks that very little time was lost in either year, as the principal berths are covered.

Systems of Payment.—Out of thirty-six firms who have furnished information, only two report that they had no system of payment by results in operation at all. A good many different systems were in operation. A certain number of changes in payment by results have been made between 1913 and 1919. An immense variety of classes of labour were reported in both years who were working on payment by results.

A considerable number of cases were quoted of men on time work in 1913 who are now on some system of payment by results. It is stated the results have been satisfactory because output has been increased. In two cases it is reported that payment by results was introduced during the war, but has since ceased ; in one case it is mentioned workmen declined to continue.

A considerable number of cases are reported of delay to pieceworkers due to waiting for other workers who work on time. This applies to joiners and carpenters, who work on time, holding up other departments. In one case it is stated that patternmakers working on time are responsible for delay in foundries, which, in turn, hold up the machine shop. A number of cases are mentioned where output is restricted, due to the fact that assistants are paid on time. In one case it is mentioned that pieceworkers make habitual payments to their assistants in excess of their standard remuneration. When blacksmiths had changes from time to piecework, their assistants shared in earnings in a certain ratio, and, as a consequence, output has increased from 50 to 100 per cent.

In a number of cases the wages of the assistants are paid by the pieceworkers, and in such cases it is to the obvious interest of the pieceworker to see that his assistants work satisfactorily. In a number of cases the assistants are not paid by results.

In one case it is remarked that when helpers were paid by the pieceworkers their timekeeping was worse, and in another case it is remarked that helpers have always been paid on time and they have never had any difficulty.

Some Examples of Comparisons of Output when Men are Paid by Time or by Results.

Mechanics fitting water-tight sliding shutters :—

On Time.	*On Payment by Results.*
Actual hours taken, 490.	Actual hours taken, 150.

For a short time, until their Society interfered, shipwrights worked piecework at laying decks. It was found that output was more than doubled.

Since shipwrights ceased piecework output has decreased. At that time two similar vessels were being built ; one was on piecework and one on time.

On Time.	*On Payment by Results.*
Time taken, 2601 hours.	Time taken, 1151 hours.

Riveters employed on warship :—

On Time.	*On payment by Results.*
176 rivets per squad per week.	722 rivets per squad per week.

Since the firm has paid the shipwrights by piecework work has been much accelerated.

Since framing has been done on piecework 40 per cent. of time has been saved.

Frame setting of a vessel was done on both time and piecework :—

On Time.	*On Payment by Results.*
14 weeks to do 54 pairs of frames.	5½ weeks to do 80 pairs of frames.

Two standard vessels built :—

On Time.	*On Payment by Results.*
15 weeks.	10 weeks.

Riveters on "lieu" on shell of submarine :—

When men worked piecework output was increased 50 per cent.

Platers on "lieu" at destroyer engine seats :—

When men worked piecework output was nearly doubled.

Making two 12in. ventilation cowls :—

On Time.	*On Payment by Results.*
Time taken, 30 hours.	Time taken, 14½ hours.

Making complete one 18in. ventilation cowl :—

On Time.	*On Payment by Results.*
Time taken, 17½ hours.	Time taken, 13 hours 20 minutes.

Efficiency of Production.—The firms who made returns have given particulars of output in two categories—first, the total gross tonnage launched ; and second, the total gross tonnage of vessels dry-docked and/or repaired. The figures are as follows :—

	1913.	1919.
Gross tonnage launched	1,022,720 ..	703,835
Gross tonnage of vessels dry-docked and/or repaired	5,928,128 ..	3,956,467
Number of employees	57,037 ..	65,338
Tonnage launched per employee ..	17.9 ..	10.7
Percentage decrease = 40.		
Tonnage repaired per employee ..	103.8 ..	60.4
Percentage decrease = 42.		

Canteen, First-aid Equipment, Welfare, &c.—There was a great increase in the provision of canteen arrangements in 1919 as compared with 1913. Out of thirty-four firms reporting only six made provision in 1913, whereas twenty made provision in 1919.

In regard to first-aid equipment and staff, all firms had some provision in both years, but the provision in 1919 was substantially better than in 1913. The most notable development is the provision of complete ambulance rooms in yards where previously only first-aid boxes were provided. Most yards have a voluntary ambulance corps in addition to the ambulance stations.

In regard to the washing accommodation, there was an increase in the amount of washing accommodation provided in 1919 as compared with 1913, the number who provided no accommodation being four, as compared with eight in the previous year, whereas in the case of those who made provision it appears to have been extended.

In dangerous and unhealthy occupations a number of firms provided special staging and supervision to avoid accidents. Gloves and leather aprons are supplied to workers using oxy-acetylene, and medicine and washing arrangements are supplied for workers working in lead and other dangerous materials.

In regard to welfare arrangements, out of thirty-five firms reporting, only five had welfare arrangements in 1913, whereas in 1919 twenty firms had made arrangements, and in many cases these were very extensive. In a good many cases very large expense had been incurred in connection with clubs, sports grounds, and so forth.

General.—Under the heading of general remarks, one firm states that output for the 47-hour week has decreased as compared with the 53-hour week. Another firm states that, when dry-docking, shipwrights demand double the number of men, and the local union will only allow their own union men to shift or remove vessels. In another case it is stated that vessels docking for painting are docked for three days instead of one and a-half, owing to refusal to work overtime. One firm states that, owing to the extensive character of repairs due to damage and wear and tear due to the war, ships are longer in dock, consequently a fewer number of vessels are dealt with.

In regard to interference to output, due to out of balance of work, little was reported for 1913, but a good deal for 1919. Shortages of labour are stated as follows :—Riveters, joiners, painters, shipwrights, plumbers, carpenters, cabinetmakers, french polishers, boat builders. The same shortages do not appear in every case. It is also stated that the balance of work was upset owing to shortage of steel plates and other kinds of steel, and the moulders' strike is also given as a cause of trouble in one case. One firm states that the shortage of shipwrights, joiners and plumbers is of a permanent character, and the same firm also mentions that questions of demarcation of work seriously affect output. Another firm reports interference of output owing to the refusal of platers, riveters, caulkers to work overtime.

Lantern Slides.—Belliss and Morcom, Limited, Ledsam-street Works, Birmingham, inform us that they have the following sets of lantern slides, each consisting of twenty slides with a booklet of descriptive matter, which they will be pleased to supply on loan free of charge for lecture purposes :—(1) Quick-revolution engines with forced lubrication ; (2) the production of power at low cost in conjunction with heating and drying by exhaust steam.

Students' Premiums.—The Council of the Institution of Electrical Engineers has awarded the following students' premiums, of the value of £10 each, to :—Mr. C. Dawson (Birmingham) for his paper, "Testing of Materials Used in Manufacture of Electrical Machinery ;" Mr. A. Tustin (Manchester), for his paper, "Hydro-electric Power Supply ;" Mr. J. C. Stewart (Glasgow), for his paper, "Electricity in Mines ;" Mr. J. A. Cooper (Birmingham), for his paper, "Long-distance Telephony ;" Mr. H. S. Petch (London), for his paper, "Automatic and Semi-automatic Railway Signalling ;" Mr. F. C. Lawrence (Manchester), for his paper, "The Engineer and Manufacturing Cost." The Council has also awarded the following scholarships :—A Salomons Scholarship, value £50, to Mr. A. H. Maggs, of Bristol University ; a David Hughes Scholarship, value £40, to Mr. W. H. N. Hellier, of University College, Cardiff ; a Paul Scholarship, value £50, to Mr. C. A. Wilck, of Finsbury Technical College, London.

Fuel Economy.*

No. II.†

I. The Coal Situation (*continued*).

There still seems to be some difference of opinion as to whether from the commercial point of view it will be better to carbonise at temperatures round about 600 deg. Cent. or at somewhat higher temperatures—say, 700 deg. to 750 deg. Cent.—but this may be regarded as a minor issue. It seems now to be established, as the result of fairly large scale trials, that the average yields of the various products now obtainable by carbonising suitable British bituminous coals at a temperature of 600 deg. Cent. will amount—on the weight of the dry coal carbonised—to about 7.5 per cent. of tars, and about 2.5 gallons per ton of motor spirit, besides about 3500 cubic feet per ton of a rich gas of a gross calorific value (say) of about 800 B.Th.Us.,‡ and a 70 to 80 per cent. residue of smokeless semi-coke.

Seeing that the cash value of the semi-coke residue far exceeds that of all the other products put together, and also that the price of fuel oil in this country will probably also be determined by circumstances beyond our control, it seems as though the ultimate prospects of a low-temperature carbonisation industry will depend upon the price which the public will be willing to pay for a smokeless domestic fuel. There can be little doubt but that such a fuel, properly manufactured, is a very suitable one for domestic consumption ; it burns freely and smokelessly, and also, according to Dr. Fishenden's recent experiments —*vide* Fuel Research Board Special Report No. 3—it has a greater radiant efficiency than either coal or high-temperature coke. Its general adoption, however, will probably depend upon two other conditions being fulfilled. First, it must be prepared and distributed in a form which will allow of its being freely handled without undue disintegration. Secondly, if its ash content could be cheaply reduced to a low figure by subjecting the coal to some washing process such as froth flotation or the like before it is carbonised, its attractiveness as a domestic fuel would be undoubtedly greatly increased. Indeed, it seems possible that public opinion might soon be educated to regard with favour well-manufactured smokeless semi-coke of better combustibility and of smaller ash content than raw coal.

From this point of view, the recent work of Sutcliffe and Evans upon the influence of porosity on the combustibility of solid fuels (*loc. cit.*) is of interest, inasmuch as it draws attention to a factor whose significance is not always sufficiently recognised in fuel technology. These authors consider the porosity of the cell walls of a carbonised fuel to be extremely important in determining its combustibility. Their suggestion that, before the coal is carbonised for the production of a free-burning smokeless domestic fuel, it should be finely pulverised and briquetted by pressure without the use of a binder in order that the thermal availability of the resulting semi-coke may be raised to a higher level, deserves further investigation from both the technical and commercial standpoints, especially if it could be found practicable to combine it with some preliminary washing process in order to reduce the ash content of the semi-coke.

Supposing that further technical developments result in the establishment of a low temperature carbonisation industry for the manufacture of a smokeless domestic fuel, it is of interest now to forecast the effect of such developments upon the future home supplies of motor spirit and fuel oils. It may be provisionally assumed that the amount of coal which could be so carbonised to supply domestic fuel requirements would be at least 40 —and possibly even 50—million tons per annum. Taking the former of these two figures, this would mean a possible production of about 100 million gallons—or about 350,000 tons—of motor spirit, and 600 million gallons —or about 2,750,000 tons—of anhydrous tars (fuel oils).

Present Tendencies in the use of Oil Fuel.—Before the advent of the internal combustion engine, the term "fuel oil" was restricted to an oil intended to be burnt in furnaces and the like. In the early days of oil fuel practice comparatively light oils were used. They were "atomised" and injected into the boiler furnace or the like by means of steam or air, and the burners used were often of a crude and unsatisfactory character. In recent years, however, more attention has been given to the proper design of such burners, and to the more effective combustion of the fuel oil. The consumption of air or steam by the oil burners has been considerably reduced, and, as they have attained a higher degree of mechanical efficiency, heavier oils have been successfully used in them. Methods have now been devised whereby heavy oils may be sprayed into the furnace under pressure alone, without the aid of either steam or air ; and, therefore, it has become possible for heavy petroleum residues, such as asphaltum, to be employed as first-class fuels for land installations. A similar tendency has recently been manifested in the use of fuel oil in internal combustion engines. Until very recently petroleum refiners prepared a very light fuel oil for these engines, but mechanical research is now being directed in order to render them capable of burning even the heaviest oils. Progress in this direction has been greatly helped by scientific investigations upon the spontaneous ignition temperatures of fuel oils. The outstanding question to-day is how to adapt a heavy fuel oil for use in low compression internal combustion engines ; this is now receiving the close attention of scientific investigators, and it may be hoped that as a result of their work the public will in due course be enabled to use heavy fuel oil in the place of motor spirit.

III. The Chemistry of Coal.

Progress towards the solution of the problem of the constitution of coal substance can be recorded, notwithstanding the magnitude and complexity of the problem. The difficulties arise in no small measure from the absence

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* Fifth report of the Fuel Economy Committee, presented to Section B, Chemistry, British Association, Hull meeting, 1922.

† No. I. appeared September 29th.

‡ The Fuel Research Board's report gave figures which would average about 1000 B.Th.Us., but the Committee has thought it better to adopt the more conservative estimate of 800 B.Th.Us. here.

from the products of such researches of bodies with crystalline habit or other well-defined physical characters by which the chemist is accustomed to identify the compounds he isolates. Still, the literature shows the subject has attractions for not a few chemists who, employing various methods of attack, seek to obtain information as to the nature of the multifarious compounds which go to the make-up of coal. As, however, different investigators select for their study coals of varying origin and of different classes, it is not always easy to compare the results obtained.

The work of Clark and Wheeler—"Transactions," Chemical Society, 1913, 103, page 1704—combining the application of solvents with the study of the action of heat upon the extracts of the coal so obtained, has undoubtedly given much useful and valuable information. The results, however, still leave open to conjecture and theoretical explanation the true nature of the components of the several fractions. The classification of the coal components by Clark and Wheeler based upon the pyridine-chloroform treatment is too facile; nor could it be expected to provide material for a complete explanation of the properties of coal.

The breaking down of a bituminous coal by treatment with a mixture of pyridine and amyl alcohol yields an extract from which, by successive use of ether and light petroleum, Bone, Pearson, Sinkinson, and Stockings—"Proceedings," Royal Society, A, vol. 100, 1922, page 582—have succeeded in obtaining (1) a non-resinous wax-like substance, (2) a resin, to which the formula $C_{31}H_{32}O_3$ is assigned, (3) a portion, insoluble in ether, consisting of non-resinous material, partially dissolved by alcoholic potash, and this they designate as "humic substance." The authors are satisfied that these humic substances are not "resinic" but "cellulosic" in origin. The influence of these several fractions on the coking of a coal has been studied, with the result that, whereas the said resin is in part responsible, the main cause of the coking propensities was shown to be a series of substances of "humic" type which are soluble in chloroform but not in ether, and whose fusion temperatures are below those at which they undergo rapid decomposition.

The acidic substances extracted by alkalis from the aforesaid humic bodies are precipitated by acids from these solutions, as bulky, dark-coloured, opaque jellies. These jellies on drying form black, brittle, lustrous, and structureless masses, with conchoidal fractures, suggestive of the material forming bright coal which Stopes has styled "vitrain." The consideration of these facts has led Bone and his co-workers to suggest that "bright coal" may have originated in a colloidal gel.

In this connection attention may be directed to a like conclusion arrived at by Dr. J. A. Smythe in 1906, in a paper read before the University of Durham Philosophical Society§ which dealt with certain peaty deposits from a pit-fall at Tantobic, County of Durham. Amongst the substances described is a black jelly-like body, which Smythe styled "black-stuff," and this he showed by its composition and behaviour to solvents, notably to pyridine, suggests a similar relationship to bright coal.

It has long been recognised that bituminous coals contain three easily distinguishable components, which until recently had usually been designated (*a*) "mother of coal" or "mineral charcoal," (*b*) "dull hard coal" (Ger.="Mattkohle"), and (*c*) "bright coal" (Ger.="Glanzkohle"), respectively, the last named being a structureless, lustrous substance with a conchoidal fracture. Recently Stopes—"Proceedings," Royal Society, B. 90 (1919), page 470—proposed new names for them, namely (*a*) fusain, (*b*) durain, whilst (*c*) is termed by her either clarain or vitrain, according as it does or does not contain recognisable plant tissues and structures. In putting forward these proposals Stopes recognised that none of the four said ingredients—with the possible exception of vitrain—are either homogeneous or chemical molecular units; also that they do not even approximately represent the crystals in a petrological section of a rock. Provided that such qualifications are kept clearly in mind, and that it be realised that clarain may prove to be merely vitrain in which plant structures occur in suspension, the Committee sees no great objection to the provisional substitution of the proposed new names for the older ones, regarding the matter more as one of convenience than as involving any new principle.

The Committee also feels that the growing practice among coal chemists to use the terms alpha, beta, gamma, &c., to designate the several components obtainable from the coal substance by fractional extraction of it by means of various solvents, is one which, unless regularised in some definite way, is likely to lead to much confusion and obscurity, to the detriment of progress. It is obvious that coal may be "fractionated" in as many different ways as there are suitable solvents and modes of applying them; and therefore unless, as the results of some particular treatment or procedure, components of a reasonable degree of purity and well-defined properties are isolated, it is undesirable that definite names should be assigned to them, as though they were the actual chemical constituents of the coal instead of unknown mixtures of them. The Committee, therefore, would suggest that the time has come when chemists should agree in conference upon some common plan of labelling such "coal fractions" which, whilst recognising them to be such, shall also in some way indicate how they have been obtained.

Supposing, for example, that a particular investigator extracts a coal with two solvents A and B, he might designate the fraction which is insoluble in both as the α AB fraction, whilst β AB might be used to denote the fraction which is soluble in A but not in B, and the γ AB that which is soluble in both A and B, assuming all solvents to be used at their respective boiling points at atmospheric pressure. Thus, a fraction termed the "α pyridine-chloroform" fraction would mean the residual insoluble portion of a coal after successively extracting it with pyridine and chloroform at their respective boiling points; the "β pyridine-chloroform" fraction would be that portion of the pyridine extract which is insoluble in chloroform; whilst the "γ pyridine-chloroform" fraction would mean the portion of the coal which is soluble in both pyridine and chloroform, and so on. In cases where the coal is extracted at some particular temperature other han the boiling point at atmospheric pressure of the solvent employed, the actual temperature employed might be designated by putting it in small type above the name of the solvent, thus "-benzene$^{120°}$" denoting that benzene had been used at 120 deg. Cent.

§ University of Durham Philosophical Society "Proceedings," Vol. 2, Pt. 6.

IV. Brown Coals and Lignites.

Although Great Britain itself is almost destitute of sub-bituminous coals and lignites—the Bovey Tracey deposit in Devonshire being the only important one in this country—the problem of using them efficiently is of great importance to several of the Dominions, and especially so to Australia, Canada, and India. Of the total estimated Canadian reserves, amounting altogether to 1,234,268 million tons, no less than 1,072,627 million tons are of a sub-bituminous lignitic class occurring in the upper cretaceous formations of the province of Alberta, whilst in the neighbouring province of Saskatchewan there are both cretaceous and tertiary lignite reserves amounting to 59,812 million tons. The Dominion Government has set up a Lignite Utilisation Board for the purpose of investigating the best means of utilising these resources, and it is hoped that the approaching meeting of the Association at Toronto in 1924 will afford an opportunity of discussing the problem in all its bearings.

In Australia, the provincial Governments of Victoria, South Australia, and New South Wales are all interesting themselves in the utilisation of their brown coal and lignite resources. Of these, the celebrated Morwell deposits in the Gippsand district of Victoria, which are of phenomenal thickness without parallel elsewhere in the world, are of great scientific interest, as well as of economic importance for the future of Australia. It has been estimated that within an area of 50 square miles in the Latrobe Valley, and within 1000ft. of the surface, there are 31,144 million tons of coal. A bore-hole put down near Morwell disclosed no fewer than seven beds of brown coal within 1000ft. of the surface, of a total thickness of 781ft., the individual seams, taken in order from the surface, running 29ft. 8in., 25ft. 8in., 23ft., 227ft. 10in., 265ft. 6in., 166ft., and 43ft. 8in. respectively. So far as they have been examined, they were reported by the Victorian Advisory Committee on Brown Coal, in 1917, as consisting of "a matrix of earthy brown coal, with sporadic inclusions of lignite . . . the matrix consists of pollen grains, spore cases, and decomposed vegetable matter. . . . The coal varies in colour between yellowish brown and black, but it always pulverises to brown powder." The raw coal usually contains about 50 per cent. of water; the dry coal contains:—Carbon = 62.5, hydrogen = 4.85, nitrogen = 0.45, sulphur = 0.20, oxygen = 28.00, and ash = 4.00 per cent. Its gross calorific value is about 5600 K.C.Us. per kilogramme.

In the year 1917 the Advisory Committee appointed by the Victorian Government to investigate the possibilities of generating electric power on a large scale from the Morwell coal reported that, notwithstanding its low grade, power could be more cheaply generated from it for the City of Melbourne than from black coal imported from New South Wales. It has been officially estimated that the cost of producing raw Morwell coal at the mines will not exceed 2s. 6d. per ton. The Victorian Government has already authorised the expenditure of £6,000,000 upon the development of the Morwell coal deposits in the expectation that by the year 1924 electrical energy from thence will be supplied, not only to the City of Melbourne, but also throughout the whole State of Victoria. It has been calculated that the cost of such energy at the mine will be as low as £2 17s. 6d. per horse-power per annum, and that it can be sold profitably to manufacturers throughout the State at an average price of £4 8s. per horse-power per annum. Large-scale steam trials are, or have been, in progress with a view to ascertaining how the coal may best be burnt under boilers, and a large electric power-station scheme at Morwell is rapidly materialising, and a large order for water-tube boilers in connection therewith has recently been placed in this country.

The problem of how such low-grade fuel as brown coals and lignites can be most efficiently burnt in boilers has therefore become one of great importance. It is obvious that a prime condition of efficient combustion is that coal shall be dried before being burnt; and as this drying can be effected at the expense of some of the sensible heat in the waste gases from the boiler, provided that they contain not less than 10 per cent. of carbon dioxide, such a drying operation may be cheaply carried out as an integral part of the boiler operation. Whether or not, as an addition to such drying operation, the coal should be subjected to a preliminary low-temperature carbonisation, using the residue therefrom as the boiler fuel, is a matter for future investigation to decide. In this connection attention may be drawn to the recent discovery made by Bone—"Proceedings," Royal Society, A., vol. 99, 1921—whilst investigating Morwell brown coal, Saskatchewan and other typical lignites:—

> (*a*) that there is for each particular brown coal or lignite a certain definite temperature limit—usually between 300 deg. and 400 deg. Cent.—up to which it may be heated, in the dry state, so as to effect a considerable chemical condensation in its cellulosic or humic constituents, with simultaneous expulsion therefrom of steam and carbon dioxide, together with a small but variable proportion of carbonic oxide; and that such chemical condensation is unaccompanied by any other change productive of either hydrogen or hydrocarbons;
>
> (*b*) that, by means of such condensation, substantially the whole of the potential energy of the fuel may be correspondingly concentrated by suitable heat treatment—within the prescribed temperature limit—in the resulting carbonaceous residue, which may therefore be burnt with greater calorific intensity than the original coal; and
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> (*c*) that, accordingly, such treatment constitutes a possible means of "up-grading" brown coals and lignites generally, thus improving their fuel values.

V. Domestic Heating and Cooking Appliances.

A good deal of valuable investigation work has recently been done by persons not actually engaged in the industries concerned in the direction of testing the efficiencies of domestic heating and cooking appliances, with results of considerable interest in connection with the important question of fuel economy in our homes, where are burnt not only some 40 million tons of coal per annum, but also the bulk of the gas and some of the coke sent out from the country's gasworks.

In the first place, physiological research has emphasised the intimate connection, from the point of view of health and comfort, between the cognate problems of heating and ventilation in regard to domestic apartments. Moreover, the introduction of the Kata-thermometer has placed at our disposal a new method for estimating the "cooling power" of the air, which has been shown to be a governing factor in regard to what may be termed "comfort conditions" in living rooms. Also, the physiological value of radiation from a red-hot incandescent surface, as distinct from convected heat, has become to be more clearly recognised than ever before. Indeed it may be said that the more nearly the conditions under which our living rooms are warmed and ventilated approach those of a warm summer's day—a cooling breeze blowing round the head, the varying sunshine warming one side of the body, and the warm ground for the feet—the more comfortable and healthful will they be. The desirability of such conditions, which may be contrasted with the warm air of rooms heated by convection from steam coils, probably explains the Englishman's decided preference for the radiation from an open fireplace during our dreary British winters over the various forms of central heating which are favoured in America and other countries where the winters are colder but brighter. Therefore, having regard to the character of British winters, the estimation of the "radiant efficiencies" of domestic fires is of predominant importance.

The "radiant efficiency" of a modern gas fire may be said to be about 50 per cent. on the net calorific value of the gas burnt therein; moreover, experiments made under Professor W. A. Bone's direction at South Kensington have proved that, within wide limits, such radiant efficiency is independent of the chemical composition and calorific value of the gas burnt, provided that the number of calories by combustion developed per hour is kept suitably constant for the particular size of fire. Gas fires are now available which are capable of ventilating rooms quite as well as an open coal fire; and it may be taken for granted that both these appliances are capable of providing a healthful source of radiation for the warming of living rooms without unduly heating the atmosphere thereof. With regard to electric radiators, whose radiant efficiency may be as high as 75 per cent., while these are very portable and therefore convenient for placing where the heat is required they do not directly ventilate an apartment.

The recent determination by Dr. Margaret Fishenden, for the Manchester Corporation Air Pollution Advisory Board, of the radiant efficiencies of coal, coke, and semi-coke when burnt in open fire-places—Fuel Research Board Special Report No. 3—are of considerable interest. Her experiments have shown, not only that such efficiency is much greater than has generally been supposed, but also that there is not so much difference as might be thought between the efficiencies of different grates.

Working with a number of coal-fired open grates, including what were supposed to be the best and the worst types, the radiant efficiency in all cases was found to lie between 20 and 24 per cent. of the heat of combustion of the coal actually burnt during each test. When dried coke was used as fuel, radiant efficiencies up to 25 and even 28 per cent. were obtained; the values were however materially diminished when wet coke was used. Tests made with the low-temperature carbonisation "semi-coke" gave radiant efficiencies of up to 33 per cent. in a grate which with ordinary coal gave 25 per cent. It is also to be noted that the tests showed that, within the limits likely to be encountered in practice, with domestic fire-grates the radiant efficiency was found to be independent of the draught intensity, and also confirmed previous experience that treatment of the fuel with preparations, consisting mostly of common salt, which are sometimes advertised as doubling the value of a ton of coal, had no appreciable effect upon its radiant efficiency. Altogether, then, Dr. Fishenden's investigations may be said to have gone far to remove from the open fire-place the stigma of gross inefficiency.

The Fuel Research Board have also published some work by Dr. Fishenden which deals with the efficiency of kitchen appliances—Fuel Research Board Technical Paper No. 3: "The Efficiency of Low-temperature Coke in Domestic Appliances"—and, in addition, one of the members of our Committee, Mr. A. H. Barker, has also devoted considerable time to the difficult question of the determination of the efficiency of domestic cooking appliances. A memorandum by him on the subject is appended to this Report, the results of his experiments having been published in detail by the Fuel Research Board—Special Report No. 4.

Dr. Fishenden has concerned herself with the determination of the radiant efficiencies of the ranges examined, as well as their efficiency in the production of hot water, whereas Mr. Barker has concerned himself generally with the question of the efficiency of ranges when functioning for the production of hot water or for cooking. The latter Report also touches upon the question of gas and electric cookers, but the Committee does not propose to comment upon this aspect of the case, as it would appear to require further investigation.

Whilst perhaps it would be premature to express any final opinion as to the precise significance of the results obtained, in view of the fact that the work is from the experimental point of view in its infancy, and that rather marked differences in efficiencies are cited in the two Reports, due probably to differences in the type of range tested, the Committee desires to call attention to the very great interest of the work at the present juncture, and to the desirability of the inquiry being continued.

The combination of several different functions, namely, of a fire-heated oven, a fire-heated hotplate, a fire-heated boiler, and also a fire to warm the kitchen, would appear to involve heavy fuel consumption, as compared with the fuel required for appliances designed to perform these functions separately. Thus, for example, Dr. Fishenden obtained a water-heating efficiency of 17 per cent. from an old-fashioned open kitchen range, whilst a later type

of independent boiler—which also functioned as an open fire—gave an efficiency of 35 per cent. for water heating, and, in addition, an open fire radiation of 7 or 8 per cent. Moreover, Mr. Barker's tests yielded hot-water efficiencies varying from 7 to 17 per cent. in kitchen ranges, as against efficiencies of 40 to 50 per cent. obtainable with separate hot-water supply apparatus.

Mr. Barker's work indicates also that the existing designs sacrifice fuel economy to convenience in providing an exposed hotplate adjacent to the oven, and that the fuel consumption for oven cooking may be reduced by lagging the hotplate. It is difficult to assess the value of the house heating done by the present-day kitchen range, but any detailed review of the subject should make some endeavour to assess its value.

In the Committee's Report in 1916 it was stated that "the whole question of the domestic use of fuel bristles with difficulties and complications . . . the solution or recommendation of particular means or apparatus for domestic heating cannot always be based simply upon the question of thermal efficiency, because it also involves considerations of a physiological and even of a psychological character. In the vast majority of houses inhabited by the artisan population, the kitchen fire or stove is the only place in the house where fuel is burned." In addition, it might be added that in the latter type of house prime cost often becomes the determining factor, and sacrifices of efficiency have to be made to ensure a small capital outlay.

The Reports under review appear to the Committee to justify a reconsideration of the factors underlying the design of solid fuel types of domestic appliances with a view to determining whether improvement in fuel economy can be obtained without either an unreasonable sacrifice of convenience or an excessive addition to the cost of production. In very many cases the actual dweller has had no say in the selection of the kitchen range, nor has he the means or the facilities for replacing such as may have been provided for him.

With regard to the existing types of combined range, it is felt that attention should be called to one point in Mr. Barker's Report, namely, that the CO_2 content of the flue gases did not exceed 5.5 per cent. in the best ranges tested, and that in several cases it was much below this, suggesting that in some cases sufficient attention has not been paid to the regulation of the air supply.

The Committee would suggest the following three points for more general consideration: (1) The general adoption of means to reduce the excess of air drawn through the system by so enclosing the fire that air does not get to the combustion chamber otherwise than through the fire grate, although retaining a feature which characterises existing appliances in providing means to enable an open fire to be obtained for kitchen heating when the other functions of the range are not required; (2) the use of effective lagging of oven doors which is not generally adopted at present; (3) the desirability of removing the ordinary hot-water boiler from the range and the substitution therefor of an independent boiler, separately fired; at present it would appear that such combinations are only provided in a limited number of middle-class houses, or in the case of very large ranges.

VI. Steam Raising and Power Production.

The Committee desires to call attention to the great need there is for some more systematic effort on the part of steam users to improve the present admittedly unsatisfactory state of boiler practice throughout the country, especially in the direction of educational provision for the better training of stokers and power-station superintendents. Notwithstanding the greater attention which is nowadays paid to the subject of "efficiency" in some of the larger steam-raising installations and power stations, there still exists in far too many cases a lamentable disregard for the elementary principles of good boiler management. Indeed it may be doubted whether, taking the country as a whole, the average efficiency of steam raising exceeds 60 per cent. on the calorific value of the coal burnt, whereas if scientific operations replaced rule-of-thumb working it might be raised to 75 per cent., with consequent great saving in fuel.

The most frequent and serious cause of avoidable heat-wastage in current boiler practice arises from the fact that unnecessarily large excesses of air are usually drawn through the system owing to sheer neglect of some of the most obvious precautions. With good management it should be possible, by careful damper regulation and maintaining a correct depth of fire, to burn completely an average quality of steam coal with no greater excess of air than would give about 12 per cent. of CO_2—without appreciable quantities of CO—in the chimney gases; but far too frequently as much as twice such minimum excess of air is drawn through the system. It is not sufficiently realised how highly important to fuel economy are the proper regulation of the draught by dampers, the correct proportioning of grate area to the quantity and size of the coal burnt, and the avoidance of inleakage of cool air into the boiler setting by keeping the brickwork in good repair and well pointed, and efficiently caulking the joint between the brickwork and boiler shell. Proper attention to such elementary points would reduce the "sensible heat" lost in the chimney gases to 18 per cent. of the total calorific power of the coal burnt, whereas neglect of them often means twice such loss.

Whilst the more general use of indicating and recording apparatus may be recommended as the best automatic aids to good management, yet unless these are supplemented by intelligence and watchfulness on the part of both stokers and boiler-house superintendents they will not avail much or may be actually misleading. The Committee, therefore, desires to impress upon both manufacturers and the public education authorities the need there is not only of better boiler-house supervision but also of the better instruction and training of the boiler-house *personnel*. It cannot be urged too often upon steam users that considerable economies can be effected with existing plant and appliances, provided that they are run under the skilled supervision of properly trained men. In the case of large boiler installations it will usually pay to put them under the control of a well-trained fuel technologist, and there are several institutions in the country where such men are being scientifically as well as practically trained. Local education authorities could effectively help fuel economy by instituting in the various technical schools throughout the country properly organised classes for the instruction of stokers and the lower grades of boiler-house attendants. In addition to such classes, the institution in some of the larger centres of more advanced and specialised lectures, with opportunities for discussion, upon combustion, heat transmission, and boiler management generally for boiler superintendents and engineers, would undoubtedly be of great advantage.

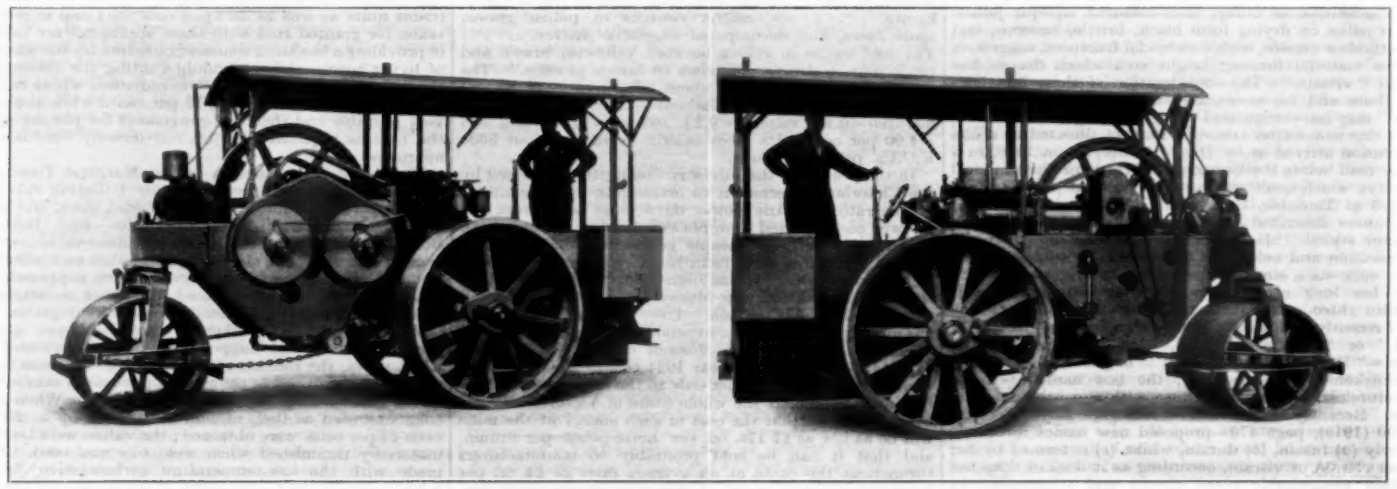
In connection with the production of electric power by public utility undertakings, the Committee would point out that the Electricity Commissioners could render a great national service if, in their annual returns, they would publish such financial and detailed technical data as are necessary to show the actual fuel consumptions and total cost of production per unit of output in the various individual power stations throughout the country. The present annual returns are not sufficiently detailed for this purpose, and in particular do not show the circumstances—such as load factor—under which the current is produced. It would undoubtedly stimulate healthy competition, promote fuel economy, and reduce costs, if the individual power stations were required to furnish for publication all the necessary technical data to enable fair comparisons to be made.

THE BRITISH COMMERCIAL GAS ASSOCIATION.

The British Commercial Gas Association will hold its eleventh annual general meeting and conference in the Lecture Theatre of the Museum and Art Gallery, at Bristol, on Monday, Tuesday and Wednesday, October 16th, 17th and 18th, 1922. The following order of proceedings has been arranged:—On the Monday there will be a reception by the Lord Mayor of Bristol, Alderman E. H. Cook, D.Sc., J.P., at 7.30, which will be followed at 8.15 p.m. by a lecture by Sir Henry Gauvain, M.D., on "Light and Life." On the Tuesday, at 10.15 a.m., members will assemble in the Lecture Theatre, and at 10.30 a.m. they will be formally welcomed by the Lord Mayor of Bristol and by Mr. J. H. Howell, the chairman, Bristol Gas Company. At 11 a.m. the presidential address will be delivered by Alderman Sir George E. Davies, and after the presentation of the annual report and statement of accounts by the executive chairman, Mr. F. W. Goodenough, a paper entitled "B.C.G.A. Service in Relation to Local Sales Development," will be read by the secretary of the Association, Mr. J. C. Walker. In the afternoon, at 2.15 p.m., there will be a public conference on "The Gas Industry as a Public Service," the opening remarks being made by the President, and the following papers being read:—(1) "The Consumer's Point of View," by Mr. S. E. Halliwell (secretary and commercial manager of the Bristol Gas Company); (2) "Gas as a Domestic Servant," by Mr. W. N. Westlake (engineer and manager of the Exeter Gas Light and Coke Company); (3) "Some All-gas Houses," by Mr. P. S. Hoyte (engineer of the Plymouth and Stonehouse Gas Light and Coke Company); and (4) "Gas Service in Health Resorts," by Mr. P. G. G. Moon (engineer and general manager of the Bournemouth Gas and Water Company). The discussion on the papers will be open to visitors. At 7.30 p.m. a dinner will be given by the chairman and directors of the Bristol Gas Company to the President, Vice-presidents, members and visitors at the Victoria Rooms, Clifton. On the Wednesday there will be a public conference on "Gas as a Service to Industry," the opening remarks being made by the President at 10.45 a.m., and the following papers being read:—(1) "Modern Gas Lighting, with special reference to the Illumination of Factories and Workshops," by Mr. Robert Watson (engineer and manager of the Doncaster Corporation Gas Department); and (2) "Gaseous Fuel and Power in Industry," by Mr. W. M. Mason, manager of the Association. The discussion on the papers will be open to visitors. At 1.30 p.m. a luncheon will be given by the Vice-presidents and members of the Association to the President of the Association and the chairman and directors of the Bristol Gas Company, at the Victoria Rooms, Clifton.

A Canadian Motor Road Roller.

As long ago as May of 1907 we described and illustrated what was then said to be the first motor-driven road roller built in the United States. It was designed by Mr. N. De Wind and had a single-cylinder paraffin engine. Since that time the designer has improved on the machine considerably, and the latest roller constructed to his plans, which is shown in the accompanying illustration, was recently exhibited in Toronto by the makers, the John Inglis Company, Limited, of 14, Strachan-avenue, Toronto.



A 45-H.P. CANADIAN MOTOR ROAD ROLLER

The new roller represents a considerable step in advance of its prototype, as might only be expected in view of the fact that over 2000 of these machines have been built in the interval, and is now equipped with a two-cylinder engine giving about 45 horse-power when running at 275 revolutions per minute. The cylinders are 8in. bore by 15in. stroke, and it will thus be seen that the engine must be well up to its job without it being necessary to drive it at an uncomfortable speed. Advantage has been taken of the two-cylinder arrangement to place the fly-wheel in the middle of the length of the crank shaft, so that it is well out of the way and the two ends of the shaft are thus left free for taking off power.

The drive is effected through toothed gearing and reversal is provided for by the introduction of two large friction clutches, which can be seen on the outside of the frame in the near-side view of the roller. The clutches are, naturally, easily accessible for adjustment and are controlled by only one lever. Two changes of speed ratio are provided, one giving a travelling speed of 1 mile and the other 3½ miles per hour. The gearing on all the high-speed shafts is machine cut.

The cam shaft and valve gear are arranged above the cylinders, so that they are easily accessible, while the valves are set in cages so that any of them may be quickly removed without it being necessary to remove any other parts. The governor acts directly on the carburetter and the charge can be heated on its way to the cylinder, if paraffin is used as fuel, to bring it up to the most effective temperature. Ignition is effected by a high-tension magneto and the engine is barred over for starting by a small petrol engine mounted over the front roller. This engine drives a roller through chain gearing, which may be brought into frictional contact with the main fly-wheel and thus turn over the engine.

The steering gear and other details of the machine follow closely the lines of the orthodox steam roller. The fuel capacity is 30 gallons, while 230 gallons of water can be carried for cooling purposes.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

Quarter Day Prospects.

THURSDAY next is Quarter Day on Birmingham Exchange, and though it is hoped that the quarterly meeting may yield some new orders, hopes cannot be said to run high. There is a good deal of pessimism in this district, for business in pig iron and finished iron is most disappointing, the autumnal demand having so far failed to materialise. It would appear to be the general view of Staffordshire ironmasters that it is now too late to expect a real revival of business this year. Works in the Black Country are only partially employed, and with the exception of a few firms producing pig iron for their own consumption, furnaces are idle. Local buying of pig iron is quite on the small side. For foundry iron in particular, the demand has shrunk to very small proportions, and there appears no prospect of improvement. If the industry were dependent upon the home demand to-day, it would be in a very bad way. The American demand is proving its mainstay, and latest advices from America fortunately indicate that this business may be expected to continue for some time, in spite of the heavy tariffs imposed under the Fordney Act. Smelters continue to complain of unprofitable prices, but although coke has been advanced 3s. per ton they cannot get an equivalent increase from pig iron consumers.

Will Marked Bars Fall?

There has been such a poor demand in recent weeks for Staffordshire bar iron that buyers are this week wondering if at the quarterly meeting there will be a drop in marked bars of 10s. or 20s. per ton. The last drop was one of 20s. declared at the April quarterly meeting. At the October quarterly meeting of last year, marked bars were declared down 50s. per ton, which brought prices to £17 10s. Since then values have been further reduced £4 per ton to the present level of £13 10s. It is in some quarters considered not at all unlikely that next week's meeting may see some fall, since very excellent Staffordshire Crown quality or merchant bars can to-day be bought at £11, though some firms ask as much as £11 5s., and so great a difference as £2 10s. between superior merchant iron and marked bars is an unnatural position for the Staffordshire market. In other quarters it is considered that there is no reason to suppose that if prices were lowered, buying would be stimulated. The market, ironmasters say, is too lifeless to encourage such a supposition. Operating costs are disproportionately high, owing to the smallness of the turnover, and production costs generally leave very little margin on the business that is being done, so that in these quarters no hope is held out of any revision of the price till the situation changes materially. It is a pertinent factor, however, that good quality Crown bars can now be bought at £11. It is interesting that when last April best bars fell £1, third-class or common bars fell 5s. to £10 7s. 6d. maximum, and last October, *i.e.*, just a year ago, they fell 30s. to £14 10s. per ton. What the drop, if any, will be next week in Crown and common bars is very problematical. To-day the last-named are £9 15s. to £9 17s. 6d. per ton, while Belgian bolt and nut bars in competition with them are selling at £8 7s. 6d. delivered Staffordshire from Antwerp.

Manufactured Iron.

There is very little demand for bar iron at the moment. Neither engineers nor industries allied to engineering are calling for anything but small quantities; consequently, there is still a good deal of idle plant in the district. The few orders available for second quality irons are the subject of the keenest competition, which tends to weaken prices. For these classes of material competition is being met with from Lancashire and Belgium, foreign No. 3 bars being offered at £8 7s. 6d. delivered in the Black Country. Even lower figures are mentioned, and although the material is inferior in quality, it is frequently preferred as against Staffordshire and Lancashire bars, which have this week been quoted £9 15s., or 2s. 6d. less than was the case last week. Belgian shippers are again this week in strong competition with home producers, and with their deliveries more dependable than some time ago, they are securing an increasing proportion of the limited business on offer. Iron strip is selling up to £11. Galvanised sheets are in moderate demand, and last week's values are maintained.

Ironworkers' Wages Again Reduced.

It is announced that the wages of Midland ironworkers, which are regulated by the sliding scale under the Midland Iron and Steel Wages Board, will be reduced a further 5 per cent. as from October 9th. The new rate will continue in operation until December 2nd. The last ascertainment resulted in a drop of 2¼ per cent., and this followed on a number of very heavy wage reductions, brought about by the fall in the prices of manufactured iron.

More Midland Iron for America.

The district trade in pig iron being very small, the orders which continue to come in from America are exceedingly welcome. Particularly is this the case, as they represent a very substantial tonnage. Certain blast-furnaces in Derbyshire and Northamptonshire are receiving inquiries from this source, running into several thousands of tons, some of which have led to business, in spite of the heavy railway rates. Good grade foundry irons are required for the most part, with smaller quantities of basic and hematite. These overseas sales have combined with high production costs to keep selling rates quite firm, but it is only in exceptional cases that any increase is conceded. However, in some cases where furnace owners in the Midlands have secured export business, values have been slightly higher. For some makes of Northamptonshire forge 6d. to 1s. over the 70s. basis is stated to have been paid; 80s. appears now to be the minimum for foundry qualities. Derbyshire makers require 72s. 6d. for forge and 82s. 6d. for No. 3 foundry. North Staffordshire No. 3 commands 84s. Midland smelters are benefiting indirectly from the American buying, owing to their ability to compete in the Northern districts with Cleveland, following the substantial advances made in the price of standard irons in that district. Values of furnace fuel continue to soar, and smelters production costs increase accordingly. The large foreign demand for coke is chiefly accountable for the advance of 3s. per ton demanded in connection with October sales. This will add materially to the cost of production, while the maker of pig iron finds it impossible in the present state of the market to pass this extra charge to the consumer of pig iron.

Midland Blast-furnace Activity.

It is regarded as a rather hopeful sign that during August nine additional blast-furnaces were lighted throughout the country, four of which were in the Midland area. Following this comes the news that it has been found possible after a long interval to light up an additional furnace at Kettering in Northamptonshire. This will add about 800 tons weekly to the output of that county. There is no prospect, however, of any furnaces being re-lighted in the South Staffordshire area. In fact, the reverse would appear to be the case, for I regret to have to announce that, in consequence of trade circumstances, Alfred Hickman, Limited, Spring Vale, Bilston, find it necessary to curtail their production of pig iron, and have decided to blow out, within the next week, one of their blast-furnaces, either at the Spring Vale Works or at the works of their allied company, Lloyds Ironstone Company, Corby, Northants. The decision, I understand, has been arrived at as a result of the continued depression of trade and the recent rise of 3s. per ton in the price of coke. Iron prices, it is stated, were inclined to sag, so that it was a case of costs going up whilst returns had a downward tendency. The blowing-out of a furnace will affect directly about sixty men. At present, four of the five blast-furnaces at Spring Vale are being used, and at Corby two out of three are in operation.

Steel Demand Growing.

Practically the only section of the market which is really displaying a stronger tendency is that appertaining to structural steel. Quite a lot of small constructional work has made the engineers somewhat busier. A few shipbuilding contracts have also been placed. The general demand for steel would appear to be expanding a little, however, partly owing to improvement in the building trade, and, as stated above, to the placing of a number of contracts in the way of constructional engineering. Good business is pending for India in connection with the bridge-work and railway demands. Rolling stock orders placed in this district are benefiting some works. The trade in sections is not being cut here to the same extent as in some of the Northern districts, local manufacturers continuing to quote angles at £8 15s. Plates are a little more inquired for, and the basis of £13 for boiler plates and of £9 10s. for ship, bridge and tank plates, is maintained. Mild steel bars are reported to have been sold at below £9, £8 17s. 6d. to £9 being about the market level. Consumers of billets are pressing for further concessions, but are not meeting with much success. Quotations this week at last range from £7 to £7 5s. There are signs of keener continental competition, joists being offered here for early delivery well below home makers' quotations. In semi-finished competition Belgium is not particularly successful just now, the latest quotation being £6 18s. delivered, as against the home quotation of £7. This is not a competitive figure, and not at all likely to lead to business.

West Midland Unemployed.

It is a hopeful sign that a further decline is shown in the unemployed statistics for the past week in the West Midland area. The decline has now been continuous for the past four weeks. The number of unemployed in the area is now 177,527. In Birmingham on the week there was a decrease from 64,427 to 63,998, but in Coventry there was again an increase, viz., from 9812 to 9962.

Colliery Matters.

In consequence of the cessation of pumping operations, the Corngreaves Colliery, Cradley Heath, has been closed and about 100 men rendered idle. Absenteeism amongst miners in the Shropshire area is stated to be steadily increasing, and to have reached about 11 per cent. at some of the collieries. Last week six miners employed by the Madeley Wood Colliery Company were summonsed under the Employers' and Workmen's Act with absenting themselves from work, and were ordered to pay 5s. a day damages and costs.

The Heavy Edge Tool Trade.

The heavy edge tool industry of this district, which has been up and down for a long time past, has slackened off again for the time being. The best markets at the moment are India and the Straits, but Brazil, South America, and Central, South and East Africa are quiet.

LANCASHIRE.

(From our own Correspondents.)

MANCHESTER, Thursday.

General Conditions.

THERE is still talk of some improvement in the market for iron and metals, and perhaps it is having a little influence; but one finds it very difficult to discover any instances in which the improvement has taken place. There have been some locomotive contracts placed, and this has led to inquiry for the necessary material; but, of course, such contracts do not swallow up much weight of iron and steel. In this respect they are very different from shipbuilding contracts, and of the latter there is no sign at present. On the contrary, the endeavour of the shipowners is at present to delay work on the contracts for which they are already responsible, and the large number of idle ships lying up at our ports is a sufficient proof that we do not want any new ships yet. Revival in the iron and metal trades is almost always connected with a large demand for new ships, and slumps in the trade follow the slumps in the shipping industry. Hence the present depression in our markets.

Metals.

The demand for refined copper in Manchester does not appear to increase at all. There is a moderate business going on at the old prices, but the movements in the London standard market appear to be without any effect on the prices quoted here for consumer's copper. The cost of best select ingot is now very moderate, but consumers are no more inclined than before to make purchases for stock and for future needs. One would be inclined to think that there was very little chance of best select ingots being any cheaper than they are now, and that it would be running no risk to keep a moderate quantity in stock; but apparently there is no tendency yet in that direction. Electrolytic copper is also moderate in price, but compared with best select it is dear and cannot be attractive except to those who require it for electrical work. It is thought that the recovery of sterling in terms of American currency will now be checked, and that the stoppage of American imports under the new and absurd tariff will prevent any further appreciation of sterling. This, of course, would tend to increase the cost of electrolytic, and widen the gap between it and English refined copper. No change has yet been made in the prices demanded for copper sheets and copper and brass tubes. These remain out of touch with the prices for the raw metals, and the reason is probably the same as that which keeps up the price of bar iron. In other words, prices are high because demand is small, and demand is small because prices are high. The costs of production are enormously increased when the machinery of production is working at 25 per cent. of its capacity. The improvement in tin has continued lately, and very considerable buying developed last week-end in the London market. There is, however, a strong belief in the market that a rise in tin prices is strictly limited, and that should any attempt be made by "bulls" of the metal to "boost" prices, the consumer, and especially the American consumer, will at once retire, and there will be no buying for consumption until prices moderate again. The Continent has been buying a little better lately, but the South Wales buyers do not show much interest in the market at present. Lead has again been recovering of late, and altogether about 15s. per ton has been gained. One has doubts about the continuance of this movement, and we have yet to see what effect the American tariff will have on the Mexican supplies. Spelter has again been a very firm market, but we are now arriving at fairly high prices, and it seems possible that we may be near the top. The position is now very different from that when spelter was selling at about the same price as English lead. Then the price was obviously low, and a rise was reasonably certain.

Pig Iron.

The market here for foundry iron is quiet and steady, and the price for Derbyshire No. 3 is still 90s. per ton delivered in Manchester. There are reports about that the buying from America is rapidly falling off, if new buying has not already ceased; but the effect on the market is not apparent because there are large quantities yet to be shipped, and it is said that these will absorb any spare pig iron up to the end of the year. The Manchester market is interesting only so far as the effect on Scotch pig iron is concerned, for the prices there have not been raised by the American demand. It is, however, clear that there would have been a great pressure of pig iron on the home market if this American demand had not just come in time to save the situation. There is said to be a little ease in Scotch iron prices here this week, but these are still far too high for the ordinary Lancashire ironfounder, and sales of Scotch iron in this district are very much restricted. Cleveland, of course, is ignored almost entirely. It is reported that another Cleveland furnace is to be started this week; but what would interest Manchester more would be the re-starting of the North Lincolnshire furnaces, which have been idle for eighteen months. There is, however, no evidence that this movement is in contemplation.

Steel.

The market here for manufactured steel is quiet, and one has not heard of any movement worth mentioning. There was some inquiry for boiler plates in connection with the orders for locomotives, but this cannot mean any serious weight of steel. At present prices it is possible that boiler plates may pay the maker; but there is no profit on the orders taken for ship plates or sectional steel.

Scrap.

The dealers in scrap seem still in rather a depressed state of mind, and the demand for old material has been very poor. Good cast scrap from broken machinery is not worth more than 80s. per ton, and ordinary cast scrap can be had at 75s. For heavy wrought scrap the Lancashire works pay 67s. 6d. per ton delivered.

BARROW-IN-FURNESS, Thursday.

Hematite.

In a few days there has appeared abundant evidence of improvement in the hematite iron trade. In the past we have viewed the trend of trade with caution, hesitating to indulge in an optimistic tone to any extent; but the signs are such to-day as point to a sound basis for indulging in the remark that trade is decidedly on the mend. During the past few weeks three furnaces have been put in blast again, one at Cleator Moor, another at Millom, and lastly, one at Ulverston. That is not all, for we hear that the Carnforth works, which have long been

idle, are preparing to start again. There has been the statement made that the demand at present exceeds the supply, but that state of things will not last for long. When Carnforth gets to work there will be only one works idle, and that is at Askam. Trade shows expansion in every direction. The continental trade is good and regular, and inquiries are increasing, and the home trade is shaping very well. Scotland is increasing its orders every week. Sheffield shows signs of improvement, and the same remark applies to the Midlands. There is an increase in the demand for special qualities on home and continental account. From Barrow last week there were cargoes of pig iron for Wales (four), Liverpool (two, for trans-shipment), Boston, U.S.A., Tréport, and Glasgow.

Iron Ore.

The local iron ore trade is improving, as forecasted in this report a few weeks ago. The increase in the number of furnaces in blast in the district has had an improving effect upon the trade, and more is being brought up. As far as foreign ores are concerned, there will be an increase in imports, although last week no cargoes arrived at Barrow.

Steel.

The steel trade, generally speaking, is not so brisk, for the Workington steel departments are doing nothing. Barrow still continues engaged in the rail and merchant mills, and the hoop mills are also fairly employed. Foundries are only moderately employed.

Shipbuilding and Engineering.

There is no development in the shipbuilding trade as yet. Perhaps the question of further reduction in shipworkers' wages of 10s. is holding up orders. It will not be long before we shall hear of developments in this branch of work. Engineers are only quiet, with better prospects.

SHEFFIELD.

(From our own Correspondent.)

A Brighter Outlook.

The trades of Sheffield are still showing signs of improvement. Progress is very slow, and the figure of unemployment still remains very near 40,000, but such movement as there is, appears to be definitely in the right direction. It is not a uniform movement, and, while some firms report favourably on the growing volume of their business, others have as yet seen no grounds for altering their gloomy view of the situation. The heavy steel branches are badly in want of work. The railway steel branch, which has been very seriously under-employed for a long time, is, however, gradually improving. The home companies are placing more orders for axles, tires, springs and other supplies. The great weight of business does not come along yet, but it is believed that, as the amalgamations get more and more completely into working order, they will adopt larger policies of renewals, in accord with their full requirements. Sheffield looks to overseas markets, both within and without the British Empire, for a large part of its railway work, and many orders from these sources are in the air. India, for instance, wants wagons by the ten thousand, and South America is also urgently in need of supplies. The difficulty about capturing this trade is one of price. The Continent and the United States are very keen competitors, and can seriously underquote Sheffield. The consumers, however, prefer British material when they can afford it, and Sheffield is hoping to hold its own when the contracts come to be given out.

Satisfactory Points.

The coal and pig iron trades have enjoyed a considerable revival, largely owing to the strike in America, and, although shipments across the Atlantic are now falling off, it is pleasant to be able to report that the blast-furnaces in Lincolnshire continue to be fully employed. Another satisfactory feature of the situation is that good time is maintained at the heavy steel works in the Rotherham district. The demand for high-grade steels shows some improvement. Several firms are benefiting, among them being William Jessop and Sons, one of the oldest and best known, who were compelled to close down last year owing to slackness, but have now been able to reopen several departments. In the cheaper classes of steel, too, there is a moderate amount of business, on which some of the rolling mills are kept busy.

Some Good Orders.

There is not much doing in the heavy engineering shops, but the prospects of improvement are considered good. A very welcome order has been received during the week by the Brightside Foundry and Engineering Company, Limited, which will provide much-wanted work for its new department for the manufacture of colliery plant and machinery. This consists of a contract to supply one of the new South Yorkshire collieries with a complete hydraulic tub-decking plant. This will include specially designed cages for the loading and unloading of the tubs, and the automatic action of charging and emptying the cages will be done by hydraulic machinery. The plant will be unique in the fact that the whole of the operations will be controlled from one central station. For the steel structure, the joists and girders will be rolled at local mills. All the pumps, rams and accumulator castings will be made and machined in the Brightside Foundry Company's engineering and foundry shops, which have been almost shut down recently. The value of the order runs well into five figures. Ruston and Hornsby, Limited, of Lincoln, have secured an order from S. Pearson and Sons, Limited, to supply thirteen dragline excavators for use in the large Sudan irrigation scheme. There was severe foreign competition for the order, but Messrs. Ruston were in an exceptionally favourable position for undertaking it, because since the Armistice they have built large works for the special manufacture of excavating machinery. The machines will be mounted on caterpillar tracks, like tanks, and some of them will weigh over 70 tons. The receipt of this order has given much satisfaction in Lincoln, where the number of unemployed is about 6000. In connection with the new Central telephone exchange which is being built in Sheffield, the Office of Works is about to ask for tenders for the steel framework. Work on the foundations of the building, where the apparatus stores of the exchange will be housed, is already well advanced. The exchange, which will be five storeys high, will consist of a steel frame with reinforced concrete floors, and communication between the floors will be by both lifts and staircases, with additional safety staircases at either end. The exchange will stand on a triangular site, with frontages of 200ft. to Bow-street, 160ft. to Pinfold-street, and 120ft. to Holly-street.

The Lighter Trades.

Although the silver and cutlery trades cannot by any means claim to be really busy, they are better employed than has been the case for some time. Some of the silver and electro-plate departments are able to keep fully at work. For the best qualities there is but a moderate demand, the goods most in request being principally of medium price and quality. There is a satisfactory increase in the volume of orders for spoons and forks, especially those of the new copper-nickel-tin alloy. The Britannia metal branch is one of the strongest of all, and has been active throughout the year, but it suffers from lack of skilled operatives. The Christmas season trade in cutlery continues to develop, but business is unequally divided, and many firms are short of work. There is a good deal of cutting in the prices of stainless knives. The table-knife department generally is faring best, but there is also better business in pen and pocket knives. The application of engineering methods to the making of cutlery has been much extended of late, and firms which have equipped themselves for this process are very hopeful of the future of trade.

The Railway Rates Handicap.

In common with the rest of the country, Sheffield is up in arms against the heavy railway rates that are in force, and the Chamber of Commerce, as well as individual traders, are doing all they can to secure an improvement. Mr. Albert Law, the secretary of the Chamber of Commerce, in a recent interview, summed up the position by the declaration that "until railway rates are reduced, manufacturers will make very little progress in business; they constitute the one great handicap." He pointed out that the modification in rates, notified by the railways to operate as from August 1st, 1922, became really negligible when one considered that, in so far as the iron and steel industries were concerned, the reduction amounted to 2d. per ton only. The general reduction of 25 per cent. and 6d. flat rate on the lighter trades was more perceptible. Lord Aberconway, at the annual meeting of the Sheepbridge Coal and Iron Company, complained that the colliery owners in Derbyshire and South Yorkshire could not sell their coal for export because of the high railway rates. If they took the shipping charges and wagons, he said, the increased rate for shipment from those parts to the Humber was 90 per cent. more than it was before the war. They were now paying 6s. 9d. per ton as compared with 3s. 9d. in pre-war days, and consequently other districts were more favourably situated in regard to the sea. Mr. Charles Markham, at the annual meeting of the Staveley Coal and Iron Company on the following day, dwelt on the same theme, and described railway rates as "something almost beyond belief." In pre-war days, he said, a ton of plates could be sent to Liverpool at a cost of £1 6s. 3d.; to-day, the cost was £2 7s.

Steel Combine's Losses.

The annual report of the United Steel Companies—the big combine which includes Steel, Peech and Tozer, the Rother Vale Collieries, Samuel Fox and Co., the Workington Iron and Steel Company, and several other important concerns—for the year ended June last, reflects the depressed condition of trade which has characterised the whole of the period. The year's working reveals a total loss of over half a million, and although the balance sheet shows a surplus of assets over liabilities amounting to £440,743, the directors say nothing about the payment of either the second half-year's dividend on the preference shares or of any dividend on the ordinaries. There are some redeeming features in the report. The company is still to a large extent a holding company, as only three of its branches have yet been liquidated. These branches are the Rother Vale Collieries, the Workington Iron and Steel Company, and the Harrington Coke Ovens. Their losses for the year amount to £156,675, but there have been brought in from them accumulated profits and other reserves which cover the losses and leave a large margin on the right side. The other associated companies lost £348,856, but in these cases also there are ample reserves. In arriving at the total loss of £505,531, stocks have been written down altogether by £298,667, and the charge of maintenance of idle plant has amounted to £312,321, so that apart from these items there was a surplus of £105,457.

NORTH OF ENGLAND.

(From our own Correspondent.)

Record Trade in Iron with America.

The pig iron exports from the Cleveland district during September reached the highest total recorded in any month since June, 1917, and rather more than half the aggregate pig iron shipments for the whole of last year. The outstanding factor was the exports to the United States. Indeed, the trade with America was phenomenal, and in the past decade no parallel can be found for such a huge Transatlantic shipment. Altogether 31,119 tons were sent, and the total American trade with the Cleveland district for the past five months has now reached 71,731 tons, and there are still very heavy shipments to be made under contract. Another interesting feature was that Germany took 8460 tons, despite the flight of the mark and the consequent difficulty of payment; whereas in the previous month only 2680 tons were exported to that country. An improved trade was also done with several other European countries. The grand total of pig iron exported was 65,361 tons, of which 51,996 tons went to colonial and foreign ports, as compared with 37,972 tons in August. There was, unfortunately, a big falling off in the foreign trade in manufactured iron and steel, the exports of which only totalled 19,423 tons, as against 28,713 tons in August. In addition, 7254 tons were sent coastwise. India was the largest receiver with a total of 7822 tons, while the Argentine Republic took 1951 tons, Victoria 1904 tons, and Japan 1497 tons.

Tees Iron and Steel Imports.

During September, 3067 tons of bars, billets, &c., 413 tons of pig iron, and 583 tons of plates, bars, angles, &c., were imported to the Tees from Holland, Belgium, France, Norway, Sweden and Germany, compared with 3479 tons, 20,320 tons, and 882 tons respectively in September, 1921. Pig iron imported from the countries named during the eleven months just ended amounted to 34,681 tons, as compared with 57,782 tons a year ago, and 1427 tons for the corresponding period of 1914. Crude sheets, bars, billets, blooms and slabs unloaded on Tees-side reached 50,264 tons for the eleven months, as against 28,323 tons for the same period a year ago, and 33,655 tons for the period ending September 30th, 1914. Plates, bars, angles, rails, and sheets totalled only 6111 tons, as compared with 20,191 tons for the same time twelve months ago, and 19,481 tons for the period ending September 30th, 1914.

Cleveland Iron Market.

A remarkably firm tone characterises the Cleveland pig iron market, and a very hopeful feeling prevails regarding the outlook. There are still large inquiries circulating from America, chiefly for the better qualities of iron, and contracts already made provide for heavy shipments during the next few weeks. The demand from several other quarters is also improving. The volume of new business is somewhat limited owing to the shortage of supply, but apart from the furnace that is going in at Bolckow, Vaughan and Company's works, there is no news of any further increase in the output. This furnace will produce Cleveland iron, thus increasing the number of blast-furnaces on this class of pig iron to eight, and for a time at least it is certain that the whole of the output will be absorbed. Most of the makers are well sold up to the middle of November. Prices remain firm, No. 1 and siliceous iron being 97s. 6d.; No. 3 G.M.B., 92s. 6d. to 95s.; No. 4 foundry, 90s.; and No. 4 forge, 85s.

Hematite Pig Iron.

There has been quite a brisk business lately in East Coast hematite pig iron. The relative cheapness has not escaped consumers' attention, and they have been buying somewhat freely, with the result that some of the makers have not only cleared out their stocks, but are well sold for forward delivery. Prices are irregular, mixed numbers having been sold at figures ranging from 89s. to 91s., but 90s. is now a fair average quotation for mixed numbers.

Iron-making Materials.

There is little or no improvement in the foreign ore trade. The nominal price of best Rubio ore is still 24s. per ton c.i.f. Tees, but consumers decline to pay that price. Good medium furnace coke is firm at 28s. per ton delivered at the works.

Manufactured Iron and Steel.

The position in the manufactured iron and steel trade shows little alteration, but the placing of a number of orders for new steamers is regarded as a hopeful sign, and it is quite possible more business will come forward in this district for shipbuilding material. Meanwhile the steel works are being kept going with small orders, and on the whole are a little busier. Prices are unchanged all round.

The Coal Trade.

The Northern coal trade retains all its recent firmness. There appears to be no falling away in the number of inquiries, many of which are now being booked, though the quantities available for early delivery are now being quickly bespoken, leaving the collieries in a very satisfactory position for any future negotiations. This week has witnessed quite a respectable amount of contracting for abroad, and so far as appearances go there is every likelihood of a continued activity in the overseas trade. The outstanding feature has been the placing of contracts by the Swedish State Railways for supplies for the next three months. The total purchases amount to about 75,000 tons. The reports in circulation all seem to point to heavy purchases still proceeding on account of Germany, which country appears now to be able to absorb any quantity of fuel which may become available in the near future. Scandinavian and French buyers are also showing more evidence of being anxious to cover their forward requirements. The entire range of the Northern market remains very strong and rigid in nearly every instance. Steam coals of every description are now firm. Even small steams are improving and are now steadying up quite definitely with not much chance of discounting. Durham classes are also well off for trade. All the best brands of gas coals are well sold out, and in the case of nearly every secondary brand the position for prompt is quite good. Coking coals are scarce and the price firm. The coke market is steady, and there is a good demand for all makes of gas, furnace, or foundry.

Ironworkers' Wage Cut.

Another reduction for the workers whose wages

are governed by the sliding scale adopted by the Board of Conciliation and Arbitration for the Manufactured Iron and Steel Trade of the North of England is announced. According to the accountant's report for the two months ended August 31st last, the output of the affiliated firms fell from 2026 tons in the preceding two months to 1898 tons, and the average net selling price dropped from £11 8s. 0.27d. per ton to £10 12s. 11.90d. per ton. On this figure there is a sliding scale reduction of 7 per cent. on puddling and other forge and mill wages, to take effect from Monday last. The total fall in wages this year amounts to 30 per cent., and the selling price is the lowest recorded since February 28th, 1916, when the average selling price was £10 14s. 4.6d.

SCOTLAND.

(From our own Correspondent.)

Shipbuilding—September Output.

During the month of September seventeen vessels of 44,320 tons aggregate were launched from Scottish shipyards, and of that total, eleven vessels of 34,915 tons aggregate were built on the Clyde. Chief amongst the latter were:—British Architect, oil tanker, 7337 tons, for the British Tanker Company, Limited, London; Teno, t.s. geared turbine, 7289 tons, for the Compania Sud Americana de Vapores, Valparaiso; Daytonian, cargo steamer, 6434 tons, for Frederick Leyland and Co., Limited, Liverpool; British Monarch, geared turbine cargo steamer, 5660 tons, for Raeburn and Verel, Limited, Glasgow.

Shipbuilding—Contracts.

While recent orders announced may not amount to anything in the nature of a boom, they, nevertheless, have given a considerable amount of satisfaction, which is not to be wondered at when one recalls the number of months that have passed when no orders at all have been coming forward to engage berths vacated by launched vessels. One at least of the orders was already placed, then cancelled, so that it would appear that costs of construction are now more in keeping with owners' ideas. There are various conditions that still require readjustment before a revival on substantial lines can be looked for, but the recent orders are held to be a most hopeful sign. The new orders include the following:—Four vessels, aggregating 23,000 tons, to be built at Port Glasgow; one of 8000 tons, at Fairfield Shipbuilding Yard, Govan; one at Linthouse, of 6000 tons; and two of 8000 tons, in another yard on the upper reaches of the Clyde. In addition, the Caledon Shipbuilding and Engineering Company, Dundee, is to build a vessel of 7000 tons for Alfred Holt and Co., Liverpool.

Pig Iron Furnaces Re-starting.

Scottish pig iron makers are still fairly busy finishing up contracts for American delivery, and these, with some inquiries from other directions, easily dispose of production. Recent orders are not quite so promising, but notwithstanding, more furnaces are to be put in blast. When these are in operation the total number in action will be thirty-one, twenty-eight of which will be producing foundry qualities. Prices are maintained.

Finished Steel and Iron.

The steel and iron markets remain in a dull and unsatisfactory condition. Buying has been of a hand-to-mouth description for a long time now, and there does not seem any inclination on the part of buyers to make any alteration in this respect. Consequently, the works in general are not engaged to anything like their full capacity, and even the plant in operation is kept going with the greatest difficulty. Recent shipbuilding orders may provide much-needed specifications for plates and release the tension a little in that department. Sectional material is only in moderate demand, while only sheets of the lighter gauges are meeting with much business, and then mostly in an export direction. Bar iron is very poorly bought and works have difficulty in maintaining a working week of from three to four days. Prices generally are unchanged, but there is little doubt that a good specification would secure better terms.

Demolishing Furnaces.

The appeals against the assessor's valuation of steel works in Lanarkshire amply demonstrate the situation in the steel industry. The appeals were in respect to the demolition at one establishment of the melting furnaces, two soakers, a sand-drying furnace and a reservoir; at another, the deletion of a melting shop; and at still another establishment, the deletion of two melting furnaces and a heating furnace.

Coal.

The coal market has been a shade firmer in tone during the past week, owing to better inquiries for round coal and renewed demands for washed materials. Substantial inquiries have been mentioned, which, if they materialise, will mean a considerable amount of business. At present the demand for round coal shows more movement, both for home and export delivery, and ells and splints in particular are a turn firmer. The better descriptions of house coal, too, are moving off freely at about 2s. to 2s. 2d. per cwt. At Fifeshire and Firth of Forth ports many vessels are expected to arrive for October loading, and the outlook is brighter. Inferior qualities of most sorts are, however, weak, and prices for them are more easily arranged. Aggregate shipments for the past week amounted to 366,370 tons, against 290,528 tons in the preceding week and 358,522 tons in the same week in 1913.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

Coal Trade Outlook.

The steam coal trade has slightly improved during the past week in some directions, though the market is what is known as rather patchy. A fair number of orders has been concluded for Italy, for shipment this month, the probability being that purchases have been effected in the belief that the trouble in the Near East may result in a bigger call for coal, with a consequent rise in price. The extra inquiry for coals has, however, so far been confined to Italy. Other markets at the moment show no expansion. Business is still being done for the States and Canada, but the demand from the Dominion is on the whole rather disappointing. For some days past news has been expected regarding the placing of a contract for 30,000 to 50,000 tons of dry coals for shipment by the end of November, but the business appears to be hanging fire, and doubts are entertained in some quarters whether anything like the above-mentioned quantity will eventually be bought. From the labour point of view there is not much fresh. The miners have held their special coalfield conference regarding the question of non-unionism, and the result is very much what was expected, inasmuch as it was decided that notices should be tendered throughout the coalfield on October 23rd to operate in fourteen days from that date. This decision was not come to unanimously, but the majority was sufficient. It was thought that it would have been decided to tender notices earlier, but the fact that the date is the 23rd gives rise to the belief that no serious trouble will be experienced, and that sufficient time was purposely decided upon to enable the leaders to carry out an intensive campaign against the non-unionist in the interval and withdraw the notices at the last minute.

Ebbw Vale Dispute.

Since writing a week ago there have been important developments tending towards a settlement of this dispute, which affects the employment of about 12,000 men. The Ebbw Vale Company laid down two conditions before work could be re-started. The first of these was that Dr. Galloway's decision upon the point in dispute submitted to him should be accepted and the award put into operation, and the second was that a guarantee must be given that would ensure continuity of employment at the coke ovens and by-product plants, and that there should be no stoppage without proper notice. These conditions were practically conceded, and it was arranged that a meeting between the representatives of the owners and the miners should take place on Monday last, to be attended by Dr. Galloway, who previously was supplied in writing with the full facts of the case for each of the respective parties. This meeting duly took place, and after arguments had been heard concerning Clause 2, which is the one in the award which is in dispute, Dr. Galloway gave his interpretation, which supports the men's contention that the allowances are to be continued, and that Dr. Galloway's final award does not abolish them. The company's representatives were asked whether the collieries would be at once reopened for work, but the miners' leaders received no reply, and up to the time of writing there was no sign of the stoppage of work terminating.

Independent Chairman and Subsistence Wage.

Lord Buxton's award concerning the application of the miners for subsistence allowances for the lower-paid workers in the South Wales coalfield was made known on Tuesday night. The award does not concede the men's full demands. Lord Buxton divides the workers into two classes. For instance, an adult worker in Class A (head of a family) will receive an amount sufficient to bring his earnings per shift up to 7s. 2d., and if he is in category B (single man not head of a family) to 6s. 8d. per shift. Allowances are made to other workers, but an important reservation is made that no worker is to be entitled to receive allowances under the award during any week in which he is voluntarily absent from work for one or more shifts without reasonable cause. Compensation men on light employment who are eligible will participate in the allowances, which are retrospective to and from September 19th. In his award Lord Buxton says that he does not consider that it is possible to make an equitable interpretation of the term "subsistence wage," or to determine what allowance, if any, is required in addition to the ordinary daily wage to provide a subsistence wage unless regard is had to the minimum family needs of the wage earners concerned. The miners' leaders have not taken the award of the independent chairman at all well, the President of the Miners' Federation, in criticising it, having remarked that the award represents the standard of living that a peer of the realm thinks good enough for the Welsh miners. The award means the addition of from £30,000 to £40,000 per month to the coalfield wage cost.

Dock Charges.

Representatives of the coalowners, the shipowners, &c., had an interview at the latter part of last week with the general manager of the Great Western Railway Company in London concerning the question of reduced dock charges. Mr. Felix Pole announced that the company had decided to make the following concessions:—Wharfage: Reduction from 125 per cent. to 100 per cent. above pre-war rates as from October 16th. Tipping and weighing charges: Reduction from 10d. per ton to 9d. per ton as from 2nd inst. Dock rent on vessels: Reduction from 125 per cent. to 100 per cent. above pre-war rates as and from the 2nd inst. Dues on vessels taking part cargoes: On all foreign vessels where the cargo is less than the net register, charges will be levied on the cargo only, with a minimum of 25 per cent. of the net register and coupled with a proviso that if a vessel takes bunkers the bunker rate will apply; this arrangement to operate from the 2nd inst. The representatives of the traders intimated that the latter would not consider the reductions as adequate to the serious position of the coal and shipping industries.

Cardiff and the Oil Trade.

The announcement is made that a project is afoot for the establishment of oil works on a large scale at Cardiff. British and American business men are interested in the venture, and negotiations have been opened with the Great Western Railway Company for the acquisition of suitable accommodation. The scheme includes the provision of a jetty where liners and other steamers can bunker in deep water without entering the dock. The scheme does not include at the moment the establishment of refineries, as this will be done in America, but still the idea is to acquire sufficient land to enable the refineries to be built at a later date if the company should wish to extend their operations. The share capital of the proposed company is in the neighbourhood of half a million pounds, and among those who are mainly concerned in the undertaking are Mr. L. V. Curry, of New York, Captain Nicholls, of The Cloisters, Bath, and Mr. R. W. J. Sutherland, of Cardiff. The board of directors has not been constituted, but it is understood that several well-known business men are likely to be included in it.

Miners' Wages.

The certificate of the joint auditors for the month of August reveals the fact that the wages of miners for the current month will be unchanged and will remain at the minimum.

Current Business.

On the whole the steam coal market is a shade steadier, but the conditions are irregular. Superior steam coals are pretty well booked up for the best part of this month, and in one or two cases salesmen are asking up to 28s. for any further supplies, but Monmouthshire qualities are comparatively quiet and easy, and small coals display little alteration. There has been somewhat of a spurt in the demand for Italy, but it is questioned whether the inquiry will be sustained, and for this reason it is doubted whether the market will retain its steadier tone. Anthracite large coals are not so steady, but sized coals maintain a good tone. Patent fuel is on the quiet side, and pitwood is weak, supplies being in advance of requirements, with prices about 25s. to 26s.

Swansea Metal Exchange.

The tin-plate market is rather steadier, owing to the fact that buyers are coming along better, and also to makers declining lower prices owing to the cost of manufacture. Makers prefer to restrict output rather than agree to reductions in price. Some works have already stopped or are on the point of suspending operations.

Latest News from the Provinces.

LANCASHIRE.

Institution of Mechanical Engineers.

The syllabus of the North-Western branch for the first half of the ensuing session has been drawn up. The meetings will be held, as last year, in the Memorial Hall on Thursday evenings in order to avoid clashing with the meetings of other local societies. The session will be opened with a dinner at the Midland Hotel on October 26th. This will be followed by a joint meeting with the Manchester Association of Engineers at the Manchester College of Technology on November 3rd, when Mr. A. P. M. Fleming, M.Sc. Tech., will give an address on "Wireless Telephony, with special reference to Broadcasting." On November 16th a paper will be given on "Cotton Opening, Mixing and Carding Machinery," by Mr. H. Wilkinson; on December 7th, Mr. T. E. Stanton, F.R.S., will read the Thomas Hawksley Lecture; on December 21st Mr. W. A. Walsh will read his paper on "Ring Spinning Machinery"; on January 18th Mr. C. D. Andrew, of Armstrong, Whitworth and Co., will read a paper on "Machine Tools for Locomotives"; and on February 1st Mr. J. Hardman will give a paper on "Mule Spinning Machinery." The chairman is Mr. Charles Day, M.Sc. Tech., and the honorary secretary, Mr. Dempster Smith.

Engineering Golfing Society.—The autumn meeting of the Engineering Golfing Society will be held at Northwood, on Tuesday, October 10th, by the courtesy of the Northwood Golf Club. The following is the programme for the meeting:—In the morning there will be an eighteen-hole medal round for the "Hele-Shaw" Scratch Challenge Cup and Memento. Prizes also will be given in this medal round for the best and second best net scores (First Division for handicaps of 10 and under, Second Division for handicaps of 11 and over), and for the best net scores for each nine holes, Nos. 1–9 and Nos. 10–18 (under half handicap, fractions to count). In the afternoon there will be foursomes, eighteen-hole match play against bogey (three-eighths of aggregate handicap) for the "Hadfield" Challenge Cups. Mementoes and second prizes will be given.

"The European Commercial."—Diverse as may be the views on the probability of success of a commercial paper, printed in English and intended principally for English readers, but published in the heart of the European Continent, no one can withhold admiration of this ingenious and daring adventure of Sir Ernest Benn. The object which inspired the founding of the *European Commercial*, as it is called, and of which a copy of the first issue lies before us, was to give to Englishmen information unclouded by politics on the commercial affairs of Europe. The paper is written by English journalists and edited by an English editor with whose capacity we are well and very favourably acquainted. With those advantages, and controlled by the publishing experience of Benn Brothers, it starts upon its way well equipped for that success which we heartily wish it. Its appeal is, of course, to the business world, which it will inform week by week upon the commercial conditions in Europe, and, if it can continue to maintain its detachment from politics and intrigue, its services to the community of trade should prove considerable. It is published in Vienna—where it is also edited and produced—at 1, Hohenstaufen-gasse 7, and at 8, Bouverie-street, London.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. Coast—	
Native	22/6
(1) Spanish	22/6
(1) N. African	22/6
N.E. Coast—	
Native	—
Foreign (c.i.f.)	24/-

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) Scotland—		
Hematite	5 7 6	—
No. 1 Foundry	5 5 0	—
No. 3 Foundry	5 0 0	—
N.E. Coast—		
Hematite Mixed Nos.	4 10 0	4 10 0
No. 1	4 10 6	4 10 6
Cleveland—		
No. 1	4 17 6	4 17 6
Silicious Iron	4 17 6	4 17 6
No. 3 G.M.B.	4 12 6 to 4 15 0	4 12 6 to 4 15 0
No. 4 Foundry	4 10 0	4 10 0
No. 4 Forge	4 5 0	4 5 0
Mottled	4 0 0	4 0 0
White	4 0 0	4 0 0
Midlands—		
(3) Staffs.—		
All-mine (Cold Blast)	13 0 0	—
North Staffs. Forge	3 12 6	—
,, ,, Foundry	4 4 0	—
(3) Northampton—		
Foundry No. 3	4 0 0	—
,, Forge	3 10 0	—
(3) Derbyshire—		
No. 3 Foundry	4 2 6 to 4 3 6	
Forge	3 17 6	—
(3) Lincolnshire—		
Basic	4 6 6	—
Foundry	4 6 6	—
Forge	4 6 6	—
(4) N.W. Coast—		
N. Lancs. and Cum.		
Hematite Mixed Nos.	5 5 0	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
Scotland—		
Crown Bars	10 10 0	10 10 0
Best ,,	12 0 0	—
N.E. Coast—		
Crown Bars	11 0 0	—
Tees	10 0 0	—
Lancs.—		
Crown Bars	11 10 0	—
Second Quality Bars	10 5 0	—
Hoops	14 0 0	13 15 0
S. Yorks.—		
Crown Bars	12 0 0	—
Best ,,	12 10 0	—
Hoops	14 0 0	—
Midlands—		
Crown Bars	10 10 0 to 11 5 0	
Marked Bars (Staffs.)	13 10 0	—
Nut and Bolt Bars	9 15 0 to 9 17 6	
Gas Tube Strip	11 0 0	—

STEEL.

	(6) Home. £ s. d.	(7) Export. £ s. d.
(5) Scotland—		
Boiler Plates	12 10 0	—
Ship Plates ⅜in. and up	9 0 0	—
Sections	8 15 0	—
Steel Sheets ⅛in. to ⅜in.	10 5 0	—
Sheets (Gal. Cor. 24 B.G.)	—	17 12 6

STEEL (*continued*)

	Home. £ s. d.	Export. £ s. d.
N.E. Coast—		
Ship Plates	9 0 0 to 9 10 0	—
Angles	8 15 0 to 9 0 0	—
Boiler-Plates	12 10 0	—
Joists	9 0 0	—
Heavy Rails	9 10 0	—
Fish-plates	14 10 0	—
Channels	13 10 0	—
Hard Billets	8 5 0	—
Soft Billets	7 10 0	—
N.W. Coast—		
Barrow—		
Heavy Rails	9 10 0	—
Light ,,	11 0 0 to 13 0 0	
Billets	9 5 0	—
Manchester—		
Bars (Round)	9 0 0 to 9 10 0	
,, (others)	9 10 0 to 10 0 0	
Hoops (Best)	15 5 0	15 0 0
,, (Soft Steel)	12 5 0	12 0 0
Plates	9 0 0 to 10 0	
,, (Lancs. Boiler)	13 10 0	—
Sheffield—		
Siemens Acid Billets	10 0 0	—
Bessemer Billets	12 10 0	—
Hard Basic	8 5 0	—
Soft ,,	7 5 0	—
Hoops	12 5 0	—
Soft Wire Rods	10 0 0	—
Midlands—		
Small Rolled Bars	9 0 0 to 9 10 0	
Billets and Sheet-bars	7 0 0 to 7 2 6	
Gas Tube Strip	10 0 0 to 10 5 0	
Sheets (20 W.G.)	11 10 0 to 12 0 0	
Galv. Sheets (f.o.b. L'pool)	16 7 6 to 16 12 6	
Angles	8 15 0 to 9 0 0	
Joists	9 0 0 to 9 10 0	
Tees	10 0 0	—
Bridge and Tank Plates	9 0 0 to 9 10 0	

NON-FERROUS METALS.

Swansea—	
Tin-plates, I.C., 20 by 14	18/9
Block Tin (cash)	164 15 0
,, (three months)	165 12 6
Copper (cash)	63 10 0
,, (three months)	64 2 6
Spanish Lead (cash)	25 0 0
,, (three months)	24 7 6
Spelter (cash)	32 17 6
,, (three months)	32 8 9
Manchester—	
Copper, Best Selected Ingots	67 10 0
,, Electrolytic	72 10 0
,, Strong Sheets	96 0 0
,, Loco Tubes	0 1 1½
Brass Loco Tubes	0 0 11½
,, Condenser	0 1 2½
Lead, English	26 5 0
,, Foreign	25 2 6

FERRO ALLOYS.

(All prices now nominal.)

	Per Ton.	Per Unit
Tungsten Metal Powder	1/11 per lb.	
Ferro Tungsten	1/5 per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£24	10/-
,, 6 p.c. to 8 p.c. ,,	£23 10 0	9/-
,, 8 p.c. to 10 p.c. ,,	£23 10 0	8/-
,, Specially Refined		
Max. 2 p.c. carbon	£60	26/-
,, 1 p.c. ,,	£70	30/-
,, 0·75 p.c. carbon	£75	37 -
,, carbon free	1/7 per lb.	
Metallic Chromium	5/- per lb.	
Ferro Manganese	(per ton) £15 for home.	
,, Silicon, 45 p.c. to 50 p.c.	£12 10 0 scale unit	5/- per
,, ,, 75 p.c.	23 10 0 scale unit	6/- per
,, Vanadium	18/- per lb.	
,, Molybdenum	6/- per lb.	
,, Titanium (carbon free)	1/2 per lb.	
Nickel (per ton)	£160	
Cobalt	11/- per lb.	
Aluminium (per ton)	£82 to £100	

(British Official.)

FUELS.

SCOTLAND.

	Export.
Lanarkshire—	
(f.o.b. Glasgow)—Steam	21/6
,, ,, Ell	22/-
,, ,, Splint	22/- to 24/-
,, ,, Trebles	23/-
,, ,, Doubles	22/-
,, ,, Singles	20/-
Ayrshire—	
(f.o.b. Ports)—Steam	21/6
,, ,, Splint	22/-
,, ,, Trebles	23/-
Fifeshire—	
(f.o.b. Methil or Burntisland)—Steam	21/- to 24/-
Screened Navigation	28/-
Trebles	23/6
Doubles	22/6
Singles	20/6
Lothians—	
(f.o.b. Leith)—Best Steam	22/6
Secondary Steam	22/-
Trebles	23/-
Doubles	22/6
Singles	20/6

ENGLAND.

(8) N.W. Coast—	
Steams	29/6
Household	46/8 to 57/6
Coke	34/-
Northumberland—	
Best Steams	25/-
Second Steams	23/- to 24/-
Steam Smalls	15/- to 16/6
Unscreened	20/6
Household	25/- to 28/-
Durham—	
Best Gas	24/- to 24/6
Second	22/- to 22/6
Household	25/- to 28/-
Foundry Coke	37/- to 40/-

	Inland.
Sheffield—	
S. Yorks. Best Steam Hards	20/- to 21/-
Derbyshire Hards	19/- to 20/-
Seconds	18/- to 20/-
Cobbles	17/- to 19/-
Nuts	15/- to 16/-
Washed Smalls	10/6 to 11/6
Best Hard Slacks	11/- to 12/-
Seconds ,,	8/6 to 10/-
Soft Nutty ,,	7/6 to 8/6
Pea ,,	7/- to 8/-
Small ,,	2/- to 4/6
House, Branch	35/- to 37/-
,, Best Silkstone	27/6 to 29/-
Blast Furnace Coke (Inland and Export)	20/- to 30/-

(9) SOUTH WALES.

Cardiff—	
Steam Coals:	
Best Smokeless Large	27/- to 28/-
Second ,, ,,	26/- to 26/6
Best Dry Large	27/- to 28/-
Ordinary Dry Large	26/- to 27/-
Best Black Vein Large	24/6 to 25/6
Western Valley ,,	24/6 to 25/6
Best Eastern Valley Large	24/- to 25/-
Ordinary ,, ,,	22/6 to 24/-
Best Steam Smalls	16/- to 16/6
Ordinary ,,	14/- to 16/-
Washed Nuts	25/- to 30/-
No. 3 Rhondda Large	28/- to 29/-
,, ,, Smalls	18/- to 19/-
No. 2 ,, Large	21/6 to 22/6
,, ,, Through	18/6 to 19/6
,, ,, Smalls	13/- to 14/-
Coke (export)	35/- to 40/-
Patent Fuel	26/6 to 28/6
Pitwood (ex ship)	25/6 to 26/6
Swansea—	
Anthracite Coals:	
Best Big Vein Large	55/- to 57/6
Seconds	45/- to 47/6
Red Vein	42/6 to 45/-
Machine-made Cobbles	67/6 to 70/-
Nuts	70/- to 72/6
Beans	45/- to 47/6
Peas	23/- to 24/-
Breaker Duff	8/6 to 9/-
Rubbly Culm	14/- to 14/6
Steam Coals:	
Large	25/- to 27/6
Seconds	24/- to 25/-
Smalls	14/6 to 16/-
Cargo Through	19/6 to 22/6

(1) Delivered. (2) Net Makers' works. (3) At furnaces. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire and Ayrshire.

(6) Home Prices—All delivered Glasgow Station. Boiler Plates 10/- extra delivered England (7) Export Prices—F.O.B. Glasgow.

(8) Except where otherwise indicated coals are per ton at pit for inland and f.o.b. for export and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b.

French Engineering Notes.

(From our Correspondent in Paris.)

The Situation.

The little more active business that was done about two months ago when orders were given out for steam generators, electrical and other machinery has not been followed by the expected recovery in trade, which is quieter even than it was before. There are many big undertakings now in hand for which a good deal of plant and machinery will be required, but unfortunately they are mostly hampered by shortness of money, and some firms carrying them out are reported to be in serious financial trouble. It is so difficult nowadays to prepare estimates with any precision that the cost of buildings and installations is often very much higher than had been anticipated, and when the companies find it necessary to raise further capital to continue the work, they are no longer able to depend upon the financial houses, these latter having entirely withdrawn their support from industrial undertakings of any kind. How long this state of things will last it is impossible to say, for it is hardly to be expected that the "upper finance" will come to the assistance of the big engineering concerns until they can see through the situation, and it must be admitted that the affairs of some of the leading firms are by no means brilliant. The trouble has arisen partly from the way in which big concerns have acquired controlling interests in a number of home and foreign enterprises, and the failures of some of those ventures have caused serious embarrassment to the parent companies. This dissemination of interests appeared justified at a time when everybody was looking forward to a vast trade revival following upon the reconstruction work, but as the recovery is still lagging behind, those firms which distributed their efforts over too many things are beginning to see that the only hope lies in concentration. Therefore, the closing down of unprofitable manufacturing departments and the carrying out of stringent economies in others, marks the policy being pursued by many firms which find that they have been trying to move faster than the times. Everyone has the conviction that the present period of hesitation must be followed by a more active trade movement, when it will be possible to put in hand the considerable number of public works now held in abeyance.

German Trade Relations.

In looking to the possible elements of industrial revival, the one that appears to offer most promise is the development of business relations with Germany. There have been rumours of negotiations between French and German groups in which the Lorraine iron and steel industries are particularly interested, and while it is certain that some close collaboration will take place, it is pointed out that the Government can hardly allow these agreements to be given precedence over the question of reparations. If by this is meant that the Germans must first carry out their arrangements for the reconstruction of the devastated areas, it is possible that the way will be made clear in a very short time for the entering into of contracts between private groups. The idea of such collaboration is gaining ground, and is expected to mark the beginning of an industrial activity and a cheapening of products on this market which will bring about a permanent revival in the future. There is, however, a certain amount of opposition in metallurgical centres, which fear that any arrangement with the Germans will have the effect of supplying them mainly with raw material, and thereby diminishing supplies to home consumers.

The Seamen's Strike.

The application of the law replacing the eight hours' day by one of twelve is causing much more trouble amongst the seamen than had been anticipated. The Union declared that it would not organise a general strike, but it is doing something quite as effective, the men having received orders not to embark upon ships in which the new conditions of work are to be enforced. The seamen are deaf to the appeal of the Government that the twelve hours' "presence," which does not necessarily mean more than eight hours' work, can alone save the merchant marine from ruin. The eight hours' day was granted at a time when there appeared to be almost a certainty of its being adopted by other countries, and as it involved heavy charges upon shipowners, represented by an increase of about 30 per cent. in the number of hands on board, competition for freights became impossible. As there could be no question of returning to the old order of things, the struggle is bound to be long and severe, and the only losers are the seamen themselves, who are fighting against the inevitable. All the ships, except those manned by the naval reserve, are laid up in the ports, and many thousands of unfortunate passengers have found themselves stranded. The Government has temporarily suspended the monopoly of French vessels for traffic between France and the North African Colonies, and the service is now being assured by a number of foreign vessels, while it is stated that American ships are crossing the Atlantic to take advantage of the freights offered. It is hoped that with this aid the congestion of the ports will soon be relieved. The efforts of the Government to break the resistance of the men have goaded the union into desperation, to the extent that it is trying to induce foreign dockers to boycott French vessels in their ports, and by organising a general strike it is hoped to render the blockade of the French ports more effective. A disquieting feature of the struggle is that the Officers' Federation is taking sides with the men, although not with the approval of at least a strong minority of its members, a number of captains having signed a protest against the attitude of the Federation. The agitation has also affected a section of the naval reserve, which forms the greater part of the crews of Transatlantic steamers, and the departures of several ships have been delayed by the refusal of the men to embark. At the moment, the strike seems to be weakening and giving way before the action of the Government and the assistance rendered by foreign vessels, which are already getting the traffic well in hand.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

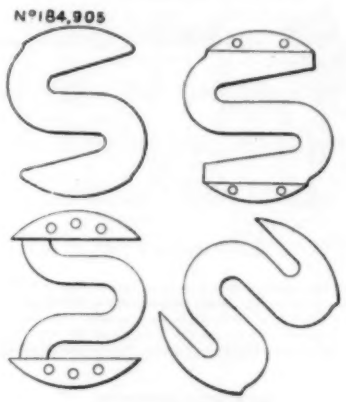
Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

INTERNAL COMBUSTION ENGINES.

184,905. May 27th, 1921.—Magnetos, The British Lighting and Ignition Company, Limited, Cheston-road, Aston, Birmingham; and E. O. Turner, 35, Mayfield-road, Moseley, Birmingham.

According to this invention, the rotary magnet of an ignition magneto is constructed in such manner that the mean length of the flux path through it is appreciably greater than the mean distance between the opposite pole shoe faces of the fixed armature, the dimensions of the magnet being such that the

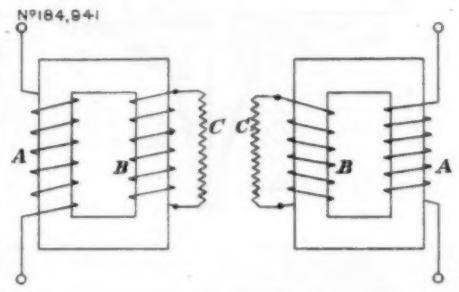


cylindrical volume it occupies when revolving is substantially the same as that of a cylinder, the diameter and length of which are equal respectively to the diameter and axial length of the stationary armature pole shoes. The diagrams show alternative cross sections, while a design in which the sinuosity of the magnetic path is arranged in the axial direction, is also described. —*August 28th*, 1922.

DYNAMOS AND MOTORS

184,941. June 20th, 1921.—Reducing Irregularities in the Voltage of Generators, G. Sutton, 18, Melford-road, S.E. 22.

The inventor proposes to smooth out the "ripple" or slight rhythmic variation in voltage produced by direct-current generators, which is detrimental to the working of telephones and other apparatus, by making these variations do work which

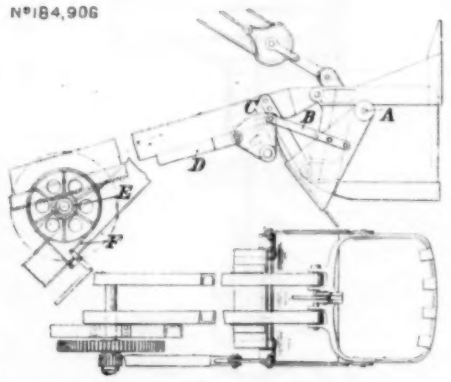


is dissipated. For this purpose he uses a transformer having primary windings A A carrying the whole current. The ripple effect produces currents in the secondary windings B B, which are dissipated as heat in the resistances C C.—*August 31st*, 1922.

CRANES AND CONVEYORS.

184,906. May 28th, 1921.—Steam Navvies, D. Whitaker, 1, Union-street, Leicester.

This navvy bucket is provided with a door or bottom, which is opened gradually, and the load is thus dumped comparatively

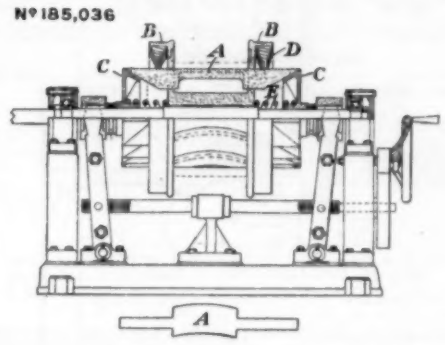


gently, so that it does not damage the wagon into which it falls. The door is pivoted about the point A and is opened by the toggle levers B and C. C is connected with the rack rod D, which meshes with the pinion E. When the pinion is held by the brake strap F and the bucket arm is racked out by the usual gear, the door is pulled open, but with the brake free the door remains closed.—*August 28th*, 1922.

TRANSMISSION OF POWER.

185,036. October 10th, 1921.—Expanding Pulleys, G. M. Emmott (Muirhead, Barr and Co.), 12, Telegraph-chambers, Market-street, Bradford.

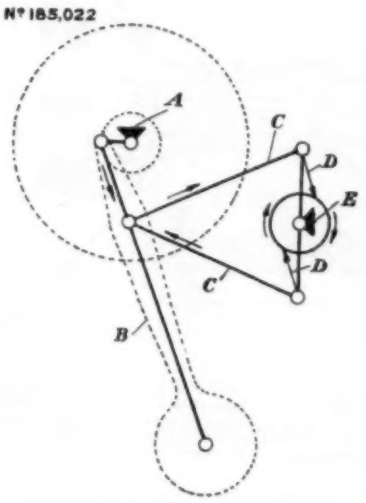
It appears that the inventor's chief claim for this expanding pulley lies in the form of the segments A A, of which its periphery



is composed. These segments have a curved contour, as shown in the detail, in order, it is said, to give the belt a better grip when the segments are expanded and thus separated from one another. The segments are kept in place by passing through slots in the spiders B B and are expanded by the cones C C and lever gear shown. Springs D and E serve to press the segments together.—*August 31st*, 1922.

185,022. August 31st, 1921.—Change-speed Gear, G. Constantinesco, Carmen Sylva, Beechwood-avenue, Oatlands Park, Weybridge.

According to the opening sentence of this specification, the invention relates to an improved method and apparatus for transmitting power from internal combustion engines or other prime movers developing constant torque to driven shafts, and is particularly applicable to locomotives or other vehicles driven by internal combustion engines. The diagram represents one of a variety of modifications of the idea. The driving shaft A is furnished with a crank, from which depends a pendulum B. The links C C, pivoted to the pendulum, actuate ratchets D D



in connection with the driven shaft E. If the resistance to rotation of the shaft E is great the pendulum will swing through a large angle, but the ratchets will only make a small stroke. On the other hand, if the resistance of E is small the ratchets will make longer strokes and the pendulum will oscillate through a comparatively small angle. The inventor states that it can be shown mathematically that, taking into account the inertia opposed by the oscillating mass, the torque on the driven shaft is proportional to the square of the speed of the prime mover. Several drawings concerned with the practical application of the principle are included in the specification.—*August 31st*, 1922.

185,329. September 7th, 1921.—Bi-metallic Wire, E. Martin, No. 80, Avenue du Parc, Brussels.

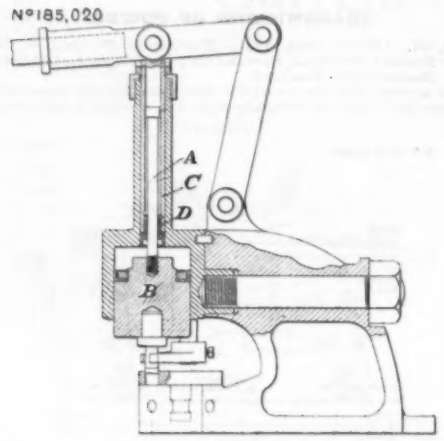
This invention has reference to the manufacture of bi-metal wires having a body of steel or iron covered with a layer of copper, brass or other similar metal or alloy, and its object is to obtain great lengths of hollow or tubular wires of steel covered inside and out with a layer of metal, such as copper of uniform thickness. The wires are prepared from a tubular bloom of bi-metal—that is to say, a bloom comprising a core of steel or iron and one or more layers of copper, brass or the like, united to the core by pressure—such bloom being obtained from a bi-metallic sheet or blank. The process consists in elongating the tubular bloom by drawing it without the use of a mandrel until a bi-metallic wire is obtained. In this way, it is claimed, wires of tubular form measuring several kilometres in length may be obtained, and the diameter of which may be reduced to a fraction of a millimetre. Also the elongation of the wire can be pushed beyond its normal elongation limit. In comparison with the usual solid wires, such as are used for the transmission of electric current, for example, the hollow wires present the advantage that, with an equal weight, they have a much greater surface for the distribution of the metal acting as a conductor, and they are especially advantageous for the transmission of high-frequency alternating currents. Furthermore, the strength of the wires is increased by their tubular form.—*September 7th*, 1922.

MACHINE TOOLS AND SHOP APPLIANCES.

185,020. August 29th, 1921.—Punching and Shearing Machines, E. M. Smith, Keynsham Manor, Saltford, Somerset.

The principal claim in connection with this little hydraulic punching machine is concerned with the means used to retract the working ram after the forward stroke has been performed.

For this purpose the rod A is screwed into the top of the ram B and extends up inside the hollow pumping ram C. It has an enlarged head which engages with the ferrule D when the pump-

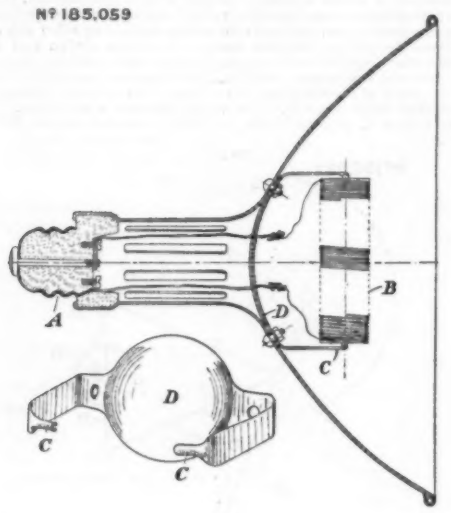


ing ram is raised to the top of its stroke, and thus raises the working ram B. The other details of the machine need no description. —*August* 31*st*, 1922.

LIGHTING AND HEATING.

185,059. January 5th, 1922.—Electric Radiators, *E. C. R. Marks*, 57 *and* 58, *Lincoln's Inn-fields, London, W.C.* 2.

The object of the inventors has apparently been to devise a cheap form of portable radiator suitable for insertion in an ordinary lamp socket. It comprises a parabolic reflector having

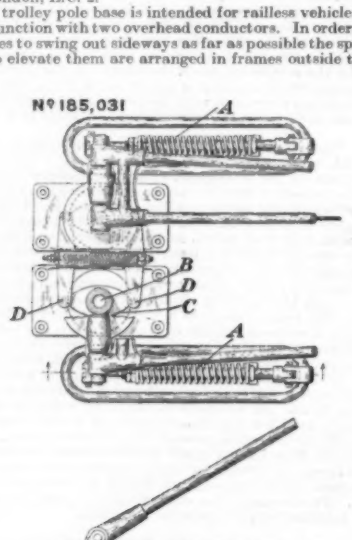


a stalk terminating in a socket A. The heating element B is supported on horns C formed on a small central piece D of the reflector. A layer of insulation is arranged between the piece D and the main reflector, while the stalk is ventilated to prevent its becoming overheated.—*August* 31*st*, 1922.

TRAMWAYS AND RAILWAYS.

185,031. September 19th, 1921.—Trolley Poles, E. M. Munro, Finsbury Pavement House, Finsbury Pavement, London, E.C. 2.

This trolley pole base is intended for railless vehicles working in conjunction with two overhead conductors. In order to permit the poles to swing out sideways as far as possible the springs A A used to elevate them are arranged in frames outside the pivots

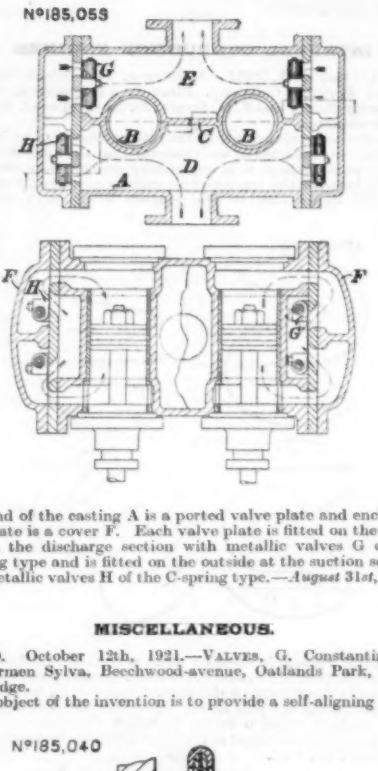


B about which the poles rotate. In this position the springs do not interfere with one another as they swing across the vehicle. On the lower part of the pole sockets there are cam plates C, shaped as shown. The rollers D D are pressed against the cams by the central springs, and assist in swinging out the trolley poles, thus relieving the overhead wires of lateral pressure.—*August* 31*st*, 1922.

PUMPING AND BLOWING MACHINERY.

185,053. December 13th, 1921.—Duplex Pumps, J. H. Carruthers and Co., Limited, G. J. Johnstone, J. Young, and D. Gourlay, Polmadie Ironworks, Hamilton-street, Polmadie, Glasgow.

This pump comprises an open-ended casting A presenting the usual cylinders B and divided by a partition C into a suction section D and a discharge section E. Removably fitted to each

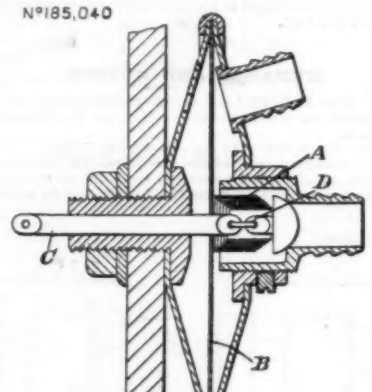


open end of the casting A is a ported valve plate and enclosing each plate is a cover F. Each valve plate is fitted on the inner side at the discharge section with metallic valves G of the C-spring type and is fitted on the outside at the suction section with metallic valves H of the C-spring type.—*August* 31*st*, 1922.

MISCELLANEOUS.

185,040. October 12th, 1921.—Valves, G. Constantinesco, Carmen Sylva, Beechwood-avenue, Oatlands Park, Weybridge.

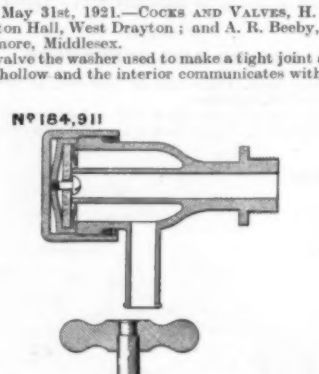
The object of the invention is to provide a self-aligning valve



which will close tight on its seat irrespective of the alignment of the part which carries the valve itself and the part in which the valve seat is formed, while the lift of the valve may at the same time be limited as desired. The valve, it will be seen, is of spherical form and is pressed against its seating by a volute spring A which bears against a diaphragm B. It is opened by pulling on the stem C, with which it is loosely connected by means of a link D.—*August* 31*st*, 1922.

184,911. May 31st, 1921.—Cocks and Valves, H. L. Milner, Drayton Hall, West Drayton; and A. R. Beeby, Nunlands, Stanmore, Middlesex.

In this valve the washer used to make a tight joint against the seating is hollow and the interior communicates with the water



under pressure. The idea is that the water pressure in the hollow will tend to press the washer firmly on its seating and keep the joint tight.—*August* 31*st*, 1922.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

FRIDAY, OCTOBER 6TH.

Institute of Cost and Works Accountants.—Connaught Hall, Newcastle. For the purpose of inaugurating a branch in the Newcastle district. Paper, "The Necessity for Scientific Costing," by Mr. S. Hunter. Tickets may be obtained from the secretary at 38, Grosvenor-gardens, S.W. 1. 7.30 p.m.

The Junior Institution of Engineers.—39, Victoria-street, S.W. 1. First meeting of winter session. Paper, "Engineering in Bacon Factories," by Mr. W. A. Tookey, M.I. Mech. E. 7.30 p.m.

SATURDAY, OCTOBER 7TH.

Institution of Municipal and County Engineers.—The Guildhall, Grantham. East Midland District meeting. 10 a.m.

Institution of Municipal and County Engineers.—Doncaster. North-Eastern District quarterly meeting. 2 p.m.

The Institution of British Foundrymen: Lancashire Branch.—The College of Technology, Sackville-street, Manchester. Presidential address by Mr. John Haigh. Paper, "The Handling of Foundry Materials." 4 p.m.

Keighley Association of Engineers.—Visit to the works of J. Blakeborough and Sons, Limited, Brighouse. Train leaves Keighley (G.N.) at 12.48 p.m.

The North of England Institute of Mining and Mechanical Engineers.—Newcastle-on-Tyne. General meeting. 2 p.m.

TUESDAY, OCTOBER 10TH.

Institute of Marine Engineers.—85/88, The Minories, Tower Hill, E. 1. "Conditions to Get High Economy from Oil Fuel," by Mr. A. Keenes. 6.30 p.m.

Engineering Golfing Society.—Autumn meeting at the course of the Northwood Golf Club. Play commences at 10 a.m.

Institution of Petroleum Technologists.—The Chemical Society, Burlington House, Piccadilly, W. 1. "The Work of the Standardisation Committee," by Dr. A. E. Dunstan. 5.30 p.m.

The Institute of Metals: Birmingham Local Section.—The Chamber of Commerce, New-street, Birmingham. Chairman's address by Dr. F. Johnson. 7 p.m.

The Institute of Metals: Scottish Local Section.—The Institution of Engineers and Shipbuilders in Scotland, 38, Elmbank-crescent, Glasgow. Chairman's address by Mr. James Steven. 7.30 p.m.

The Institution of Heating and Ventilating Engineers.—Caxton Hall, Westminster, S.W. 1. Paper, "Some Points in the Law of Heating Engineers' Contracts," by Mr. Robert Fortune. 8.15 p.m.

Manchester Geological and Mining Society.—Queen's Chambers, 5, John Dalton-street, Manchester. Annual general meeting. 4 p.m.

Institute of Industrial Administration.—London School of Economics, Houghton-street, Aldwych, W.C. 2. "Training for Administration in Industry," by Captain H. Riall Sankey. 8 p.m.

WEDNESDAY, OCTOBER 11TH.

Institution of Automobile Engineers.—The Royal Automobile Club, Pall Mall, S.W. 1. Presidential address, entitled "The Need for a Wider Outlook in Automobile Engineering," by Lieut.-Colonel D. J. Smith. 8 p.m.

Industrial League and Council.—Caxton Hall, Caxton-street, S.W. 1. "Labour: Its Status and Reward," by Major A. G. Church. 7.30 p.m.

The Institution of Heating and Ventilating Engineers.—Caxton Hall, Westminster, S.W. 1. Paper, "Heating and Ventilating of Passenger Ships," by Mr. J. L. Musgrave. 3 p.m.

The Electro-Harmonic Society.—Caxton Hall, Westminster, S.W. 1. First smoking concert of the season. 8 p.m.

THURSDAY, OCTOBER 12TH.

The Institute of Metals: London Local Section.—The Institute of Marine Engineers, 85–88, The Minories, Tower Hill, E. 1. Chairman's address by Dr. D. Hanson. 8 p.m.

FRIDAY, OCTOBER 13TH.

The Junior Institution of Engineers.—39, Victoria-street, S.W. 1. Paper, "Artificial Icemaking," by Mr. E. C. West. Slides. 7.30 p.m.

The Institute of Metals: Sheffield Local Section.—Mappin Hall, St. George's-square, Sheffield. Postponed annual meeting. Paper, "Non-ferrous Foundry Practice," by Mr. P. Longmuir. 7.30 p.m.

MONDAY, OCTOBER 16TH.

Bradford Engineering Society.—The Technical College, Bradford. Lecture, "The Still System of Internal Combustion Engine," by Mr. H. A. D. Acland. 7.30 p.m.

MONDAY TO WEDNESDAY, OCTOBER 16TH TO 18TH.

British Commercial Gas Association.—Eleventh annual conference. Lecture Theatre of the Museum and Art Gallery, Bristol. For programme see page 366.

TUESDAY, OCTOBER 17TH.

The Institute of Transport.—The Institution of Electrical Engineers, Savoy-place, W.C. 2. Extraordinary general meeting. 5.30 p.m.

WEDNESDAY, OCTOBER 18TH.

The Institute of Physics.—The Institution of Electrical Engineers, Savoy-place, Victoria Embankment, W.C. 2. Lecture, "The Physicist in Electrical Engineering," by Mr. C. C. Paterson. 6 p.m.

THURSDAY, OCTOBER 19TH.

The Institution of Mining and Metallurgy.—Cleveland House, 225, City-road, E.C. 1. General meeting.

FRIDAY, OCTOBER 20TH.

Institution of Production Engineers.—Royal Automobile Club, Pall Mall, S.W. 1. Annual general meeting. Presidential address by Mr. M. R. Lawrence. 7.30 p.m.

Institution of Naval Architects.—The Elgar Scholarship in Naval Architecture (1922) has been awarded by the Council of the Institution to Mr. William Sprague, of H.M. Dockyard, Devonport, and the Earl of Durham Prize to Mr. F. F. Crocombe, of H.M. Dockyard, Portsmouth.